# VICTORIA LINE TRAFFIC STUDY

## A REPORT ON THE TRAFFIC IMPLICATIONS OF THE VICTORIA LINE NORTH OF VICTORIA

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# A REPORT ON THE TRAFFIC IMPLICATIONS OF THE VICTORIA LINE NORTH OF VICTORIA

## 1. INTRODUCTION

### 1.1 Purpose and structure of the report

1. On 7th March 1969, when the 10 miles long main section of the Victoria Line from Walthamstow to Victoria was opened by Her Majesty the Queen, this was the first new Underground railway to cross central London for over 60 years. Apart from linking another suburban sector – Tottenham/Walthamstow – directly with the Underground network, the Victoria Line was mainly intended to provide general improvements in travel conditions, either in the form of direct facilities (e.g. by linking a number of main line terminals with each other and with the West End) or in the form of improved interchange facilities. In fact, all twelve stations from Walthamstow Central to Victoria provide interchange facilities with other Underground lines and/or British Railways. The line was, therefore, bound to have a profound effect on the pattern of travel in London.

2. It should, therefore, be of considerable interest to try and assess, in retrospect, the effect that the Victoria Line has had on this travel pattern. Such an assessment is not merely of historic interest but should also permit a better appraisal of public transport improvement schemes of this order of magnitude in the future. Moreover, by comparing the effects of the line with the estimates made prior to its opening, it should be possible to test and improve the methods used for these estimates

3. A report on the Victoria Line as a whole must still await a full assessment of the effect of the line including the Brixton extension which was opened on 23rd July, 1971. Such an assessment will only be possible on the strength of further surveys which, to provide a true picture of the permanent effect of the Brixton extension, can only be carried out over a reasonable time after the opening of the extension and will then require a further period of time to be evaluated. In the meantime, it seemed desirable to collect and analyse the principal results of the surveys and counts carried out so far for the main section of the Victoria Line from Walthamstow to Victoria, and this is the main purpose of the present report which excludes the Brixton extension.

4. Following a brief description of the Victoria Line (Chapter 1.2) and a brief account of the advance forecasts and subsequent surveys which have been undertaken so far – a "survey of surveys" (Chapter 2) – this report will deal with the results of the various surveys, especially the very comprehensive surveys carried out by London Transport in May/June 1969 and again in May/June 1970 (Chapters 3 and 4), and will compare the results with the forecasts (Chapter 5). A special chapter (Chapter 6) will deal with the household survey carried out by the Greater London Council in the northern suburbs served by the Victoria Line, and mention will also be made of early investigations into the effect of the Victoria Line on property values and land use (Chapter 7). Readers content with a brief synopsis of the surveys and their principal results may like to turn to "Summary and Conclusions" (Chapter 8).

### 1.2 Brief description of the Victoria Line

5. For those not familiar with the Victoria Line, it may be convenient to recall its main features.

As shown on Map I the line

- serves the northern suburbs of Walthamstow and Tottenham, where contact is made with three electrified suburban lines of the Eastern Region of British Railways; Railways;

- connects with the Eastern Region main line and with the Piccadilly Line at Finsbury Park which is also an important rail head for bus services from the north;

- connects at Highbury & Islington with the Highbury branch of the Northern Line which is due to be taken over by the Eastern Region as part of the electrified system of the "Great Northern" suburban lines;

- enters the central area at King's Cross where multiple connections are available with two main line terminals (King's Cross and St. Pancras) and three other Underground lines (Metropolitan, Piccadilly and Northern Lines);

- serves another main line terminal at Euston where interchange facilities are also available with the two in-town sections of the Northern Line;

crosses the West End with stations at Warren Street, Oxford Circus and Green Park, all of which provide interchange facilities with other Underground lines;

serves the important main line terminal at Victoria where the line terminated during the period covered by the present report, and since July 1971, continues southwards via Pimlico (a station opened in September 1972). Vauxhall (interchange with the Southern Region lines of British Railways) and Stockwell (interchange with the Northern Line) to Brixton, an important railhead and shopping centre in South London.

6. As already mentioned, the main purpose of the line is to provide a general improvement in travel conditions throughout Inner London through a multiplicity of interchanges with other Underground lines and with British Railways (including four main line terminals). Together with Pimlico, the line has 16 stations, including five which provide particularly convenient interchange facilities "across the platform". The total length of the line, excluding a spur from and to the rolling stock depot at Northumberland Park, is 13½ miles (21½ km.). The length of the line from Walthamstow Central to Victoria, to which the present report applies is 10 miles (16 km.) with 12 stations.

7. The capital cost incurred for the Victoria Line north of Victoria, during a construction period of about eight years (i.e., at different price levels), including rolling stock and considerable sums spent on the reconstruction and improvement of existing Underground stations, amounted to roundly £70 million. The annual operating costs attributable to the Victoria Line, i.e. after allowing for station staff costs and other expenses shared with other lines, but excluding any interest on capital, were (in 1970) of the order of £2.7 millions. The annual revenue earned in respect of travel on the Victoria Line in 1970 is estimated at over £3 million.

## 2. "SURVEY OF SURVEYS"

### 2.1 Traffic forecasts prior to the opening of the line to Victoria

8. The origins of the Victoria Line scheme go back to the "Railway (London Plan) Committee" of 1944 and, in particular, to the "London Plan Working Party" of 1948 whose report, published in 1949, contained – as a scheme deserving high priority – a proposal for a "Route C" which, in the event, became the forerunner of the Victoria Line from the Tottenham area as far as Brixton. The first detailed estimates for the traffic to be expected on the Victoria Line were prepared on the occasion of the Parliamentary evidence given in 1955 when London Transport obtained Parliamentary Powers for the line from Walthamstow to Victoria. These estimates were revised as part of a major re-appraisal in 1958 and published in the report by the "London Travel Committee" in 1959. At that time, the line was intended to go as far as Walthamstow (Wood Street). Later, this scheme was modified by omitting the latter station and terminating the line at Walthamstow (Hoe Street), now known as Walthamstow Central. For this reason, and because certain basic data (e.g. traffics on existing Underground lines and on buses) had to be updated, the traffic estimates had to be revised again, notably in 1967. Meanwhile, some progress had been made in developing traffic assignment methods, especially for assessing traffic diverted to a new Underground line from pre-existing railway lines, and as these methods were being used for the Fleet Line, an attempt was made in early 1969 to test their validity by applying them to the Victoria Line, and comparing the results with those of "before and after" surveys.

### 2.2. "Before-and-after" traffic observations

9. In addition to the major questionnaire and interview surveys, carried out by London Transport and the Greater London Council (with financial support from the Department of the Environment) and described below, certain "before-and-after" traffic observations were carried out, either 'ad hoc' or as part of normal routine observations, by

London Transport
in respect of
- train loadings on sections of the Underground system affected by the Victoria Line,
- bus loadings on routes affected by the Victoria Line;

British Railways
in respect of
- train loadings on lines affected by the Victoria Line;

the Greater London Council
in respect of
- vehicular traffic counts on certain roads liable to be affected by the Victoria Line;

the Westminster City Council
in respect of
- pedestrian traffic across Green Park.

### 2.3. Investigations into changes in land values and activity patterns

10. It is well known that a major improvement in public transport facilities is liable to have a profound influence on land values and property developments over a wide area. In fact, experience abroad (e.g. in Toronto) has shown that the increases in rateable values involved may well be considerably in excess of the capital invested in the improvement scheme. London Transport's Estate Manager has, therefore, carried out some investigations, partly through contact with estate agents, with a view to obtaining an idea of the order of magnitude of these effects which could also have a bearing on the evaluation of social benefits. Investigations were also initiated regarding the long-term effect of the Victoria Line on land use and activity patterns.

### 2.4. Household interviews at the northern end of the Victoria Line

11. Before the first section of the Victoria Line opened from Walthamstow to Highbury in September 1968, and again about one year later (i.e., about five months after the opening of the line to Victoria), the Greater London Council conducted a series of some 5,000 home interviews at or near the northern end of the Victoria Line in order to try and ascertain the effect of the line on the local travel habits in that area. The questionnaire included questions on household information (number of persons; employment; car ownership), personal details (type of occupation; income group; address of workplace; main mode of travel; use of car), and details of work trips and non-work trips.

### 2.5. Questionnaire survey, May/June 1969

12. It is this survey, in conjunction with its repeat in May/June 1970, which has yielded the most comprehensive set of data for assessing the effect of the Victoria Line on London's travel patterns. Taken together, the results of these

surveys are believed to represent one of the most comprehensive sets of traffic surveys ever undertaken on any urban railway.

13. First, during a fortnight in May 1969, – i.e. only two months after the line was opened to Victoria – one-day counts were taken systematically of passengers entering Victoria Line platforms at all stations from anywhere, i.e., from the street, from other Underground lines, or from British Railways. These counts provided a statistical calculation basis for the subsequent questionnaire survey which took place during a fortnight in June 1969 when about 60,000 questionnaires were handed to passengers entering the platforms at each access point.

14. The questionnaire was designed to obtain detailed information on all stages of each passenger's journey (for example, bus from home to Southern Region station; Southern Region train to Victoria; Victoria Line to Oxford Circus; then Bakerloo Line to Marylebone). The passenger was also asked whether he used to make the journey between the same two points *before* the Victoria Line was open, and if so, to give similar details of the form of transport (public or private) and the route he used to take. Questions were also asked as to the frequency of making the journey both *before* and *after* the opening of the Victoria Line, the purpose of the journey, etc. The object was to determine, as far as possible, the composition of the Victoria Line traffic in terms of "diverted" and "generated" traffic and, quite generally, to build up a picture of the total effect of the Victoria Line on travel by all forms of transport, private as well as public, in the London area. A further explanation of
*App. A.* the survey method and analysis is contained in *Appendix A* The computer analysis was carried out by S.I.A. Ltd.

### 2.6. Questionnaire survey, May/June 1970

15. During the summer and autumn of 1969, it became apparent that traffic on the Victoria Line continued to increase at a fairly rapid rate, and that the survey taken in May/June 1969, so soon after the opening of the line, could not be regarded as representative. It was, therefore, decided to carry out a second, similar survey at the same time of the year in 1970. This measure was amply justified by the result which indicated an overall increase in the number of Victoria Line passengers of 40 per cent.

16. The 1970 survey was conducted in more or less the same way as in 1969, except that the sample size was reduced (the response achieved as a percentage of the total traffic was 5 per cent., compared with 10 per cent. in 1969) and the questionnaire was slightly modified, though the only significant change was the inclusion of a question asking regular Victoria Line users to specify the approximate time when they first began to use the line. This was intended to elucidate some information about the build-up of the traffic over time and some data which might assist the difficult task of distinguishing between "diverted" and "generated" traffics. Further details about the method and
*App. B.* analysis of the 1970 survey are given in *Appendix B*.
The computer analysis was again carried out by S.I.A. Ltd.

## 3. ANALYSIS OF VICTORIA LINE TRAFFIC

### 3.1. Validity of the survey results

17. The quantitative survey results are essentially based on one-day counts which are liable to be affected by freak influences, although the spreading of the counts over a period of two weeks might be assumed to have had some compensating effect. Otherwise, the validity of the results derived from the questionnaire surveys depends firstly on whether the journeys reported were, in fact, representative of all travel on the line and secondly on whether the questions themselves were understood and answered in the sense intended. As with all surveys of this type, there may have been systematic differences between the 28 per cent. of passengers who returned questionnaires in 1969 (25 per cent. in 1970) and the 72 per cent. of passengers (75 per cent. in 1970) who failed to respond, i.e. it could be that very short journeys, non-work journeys, etc. were under-represented. Very little independent data exists by which to validate the survey results. However, such limited checks as were possible did not reveal any very obvious bias.
So far as comprehension of the questionnaire was concerned, respondents were likely to have had most difficulty with the final question, i.e. in the 1969 survey:–

"If you never made this journey before 1st September 1968, was this because:–

(a) the Victoria Line did not exist or
(b) for some other reason, e.g. you lived somewhere else, you were still at school, etc."

and a similar question in the 1970 survey. Some respondents may not properly have understood this question and others may have had genuine difficulty in placing their journey in one category or the other. Nevertheless, the answers are critical to the evaluation of generated traffic and much of the uncertainty attaching to the analysis described in Chapters 3.13 and 3.14 below arises from doubts about the quality of the answers to this question.

18. A further factor which may have affected comparisons between the pre-Victoria Line period (taken as before the first stage opened on 1st September 1968), May/June 1969 and May/June 1970 was the fares revisions in August/September 1968, September 1969 and November 1969 (buses only). However, it is unlikely that these affected travel patterns to an extent which could be regarded as significant relative to the errors inherent in the survey results.

### 3.2. Annual passenger mileage on the Victoria Line

19. Because many passengers use the Victoria Line for part of their Underground journey only, the most telling indication of the total annual, weekly or daily traffic on the Victoria Line is provided, not by the number of passengers, but by the total passenger mileage carried on the line.
On the basis of the May/June 1969 and May/June 1970 questionnaire surveys, and grossing up the one-day (07.00-22.00 hours) counts by the following factors based on London Transport's general experience of traffic fluctuations on the Underground over the day, week and year:

$\frac{105}{100}$ to account for early morning and late evening traffic,

$\frac{100}{17.1}$ to account for a whole week's traffic,

$\frac{100}{97.5}$ to account for the difference between a May week and an average week,

52 to account for the whole year,

the total annual passenger mileages on the Victoria Line between Walthamstow Central and Victoria corresponding to the May/June 1969 and May/June 1970 levels of traffic work out at 165 and 229 million passenger miles per annum, respectively.

20. These overall figures also provide a useful index of comparison with early forecasts and with later estimates for the Victoria Line north of Victoria, shown in chronological order below:

| | **Estimated annual passenger miles** *(millions)* |
|---|---|
| **1955 estimate** | |
| used for the Parliamentary evidence and assuming northern terminus at Walthamstow (Wood Street) | 250 |
| (Corrected to allow for the subsequent curtailment of the line to Walthamstow Central) | (242) |
| **1958 estimate** | |
| later published in the report of the "London Travel Committee", assuming northern terminus at Walthamstow (Wood Street) and G.N. electrification scheme with cross-platform interchange with Victoria Line at Highbury in operation | 263 |
| (Corrected to allow for the subsequent curtailment of the line to Walthamstow Central) | (255) |
| **1967 estimate** | |
| assuming northern terminus cut back to Walthamstow Central without G.N. electrification and allowing for some decline in bus and Piccadilly Line traffic | 203 |
| **1969 estimate** | |
| prepared immediately before opening to Victoria allowing for a further decline in bus and Piccadilly Line traffic, and using certain improved methods of calculation devised for the Fleet Line | 169 |
| **Result of May/June 1969 Survey** | |
| calculated as shown in paragraph 19 | 165 |
| **Result of May/June 1970 Survey** | |
| calculated as shown in paragraph 19 | 229 |

21. Without anticipating a more detailed comparison of the forecast and survey results (cf. chapter 5), it is worth noticing here that, after allowance is made for the curtailment of the Victoria Line at Walthamstow Central, the 1970 survey figure for the *total* annual passenger mileage on the Victoria Line north of Victoria (229m.) is approaching the earliest of the forecasts made in 1955 (242m.). Furthermore, with the completion in 1976 of the recently approved Great Northern electrification scheme which will inject additional traffic into the Victoria Line, particularly at Highbury & Islington, the traffic volume on the line (ignoring the effect of the Brixton extension) may well come up to the highest of the estimates, viz. the 1958 estimate which (after adjustment for the curtailment at Walthamstow Central) amounted to 255m. The 1970 survey figures for the total annual passenger mileage suggests that the methods used for forecasting the effect of the Fleet Line – used in an abbreviated form for the 1969 Victoria Line forecast – are well on the conservative side.

### 3.3. Daily and annual numbers of Victoria Line passengers

22. The total daily numbers of passengers entering the Victoria Line platforms, based on the May 1969 and May 1970 counts but adding 4½ per cent. for early morning and late evening traffic, amounted to:

- 186,000 in May 1969
- 260,900 in May 1970,

an increase of 40 per cent.

Corresponding annual numbers of Victoria Line passengers, using the factors quoted in paragraph 19, work out at roundly:

- 58 million at the May 1969 rate,
- 81 million at the May 1970 rate.

### 3.4. Average distance travelled on the Victoria Line

23. Through dividing the total annual passenger mileage by the total annual numbers of passengers, one obtains the average distance travelled by Victoria Line passengers on the Victoria Line itself. This works out at roundly 2.8 miles for each of the two reference dates. Because many Victoria Line passengers also use connecting Underground lines during their journey, this distance is obviously a good deal shorter than the overall average length of journeys on the Underground lines as a whole which amounted to 4.72 miles in 1969 and to 4.84 miles in 1970.

### 3.5. Traffic distribution over the stations of the line

24. Whilst Appendices A and B show the number of passengers *entering* Victoria Line platforms at each of the stations *between 07.00 and 22.00 hours* during each of the two survey periods (May 1969 and May 1970), a more comprehensive picture of the geographical distribution of the traffic over the different stations of the line can be obtained from *Appendix C* which shows the total number of passengers *entering or leaving* the Victoria Line platforms at each station of the line *during the whole of the day*, i.e. after allowing for the early morning and late evening periods not covered by the surveys. The total numbers of passengers entering or leaving correspond, of course, to twice the total number of passengers using the line or (in terms of technical jargon which will be used for brevity's sake in the following), the number of "trip ends" is twice the number of "trips". *App. C.*

25. It will be seen that the six "in-town" stations (Victoria to King's Cross inclusive) accounted for about three-quarters of all passengers entering or leaving the Victoria Line platforms while the six "out-town" stations (Highbury & Islington to Walthamstow Central inclusive) accounted for one-quarter. In fact the four stations north of Finsbury Park jointly accounted for no more than about 10 per cent. of the total number of Victoria Line passengers. In contrast, Victoria and Oxford Circus alone each served over 20 per cent. of all Victoria Line passengers, and their joint share rose, over the year, from 43 to 45 per cent., i.e. nearly one-half of all Victoria Line passengers used at least one of these two stations. The percentage shares of the outlying stations dropped correspondingly.

### 3.6. Origin-and-destination pattern

26. The origin-and-destination pattern of the daily traffic on the Victoria Line ascertained from the 1970 survey (260,900 trips, i.e. 521,800 "trip ends") is shown in *Appendix D*. The figures represent the total daily two-way traffic between any two Victoria Line stations, including all modes used to and from these stations. The total "trip ends" at each station are identical with those shown in the third column of *Appendix C*. Nearly one-fifth of all Victoria Line trips (50,400 out of 260,900) occur between Victoria and Oxford Circus. Other prominent station-to-station traffics are: *App. D.* *App. C.*

| | | |
|---|---|---|
| Victoria to | – Green Park | (19,700) |
| | – Euston | (14,700) |
| | – King's Cross | (11,200) |
| Oxford Circus to | – Green Park | (11,200) |
| | – Euston | (11,900) |
| | – Finsbury Park | (13,300) |

All other station-to-station traffics are below the level of 10,000 trips per day.

### 3.7. Traffic distribution over the sections of the line

*App E.* 27. *Appendix E* shows, for the 1969 and 1970 surveys, the daily and annual two-way volumes ("densities") for each section of the line, together with the increases from May/June 1969 to May/June 1970 (based on the daily figures), and standardized on the average annual density throughout the line (total annual passenger mileage divided by the total route mileage, 10.1 miles). The maximum two-way daily density on any section of the line occurs between Green Park and Oxford Circus where it rose from 94,000 per day in May/June 1969 to 133,300 in May/June 1970, an increase of 42 per cent. The lowest density is of course encountered on the outermost section of the line (Walthamstow Central to Blackhorse Road) where it amounted to 14,000 per day in May/June 1969 and 16,800 in May/June 1970, an increase of 20 per cent only. In terms of annual two-way traffics, the sectional densities are above the average density of the line on all sections south of Finsbury Park, and below it on all sections north of Finsbury Park. The densities on the two extreme sections of the line are of course identical with the daily or annual numbers of Victoria Line passengers at Victoria and Walthamstow Central, respectively.

### 3.8. Mode of transport used before entering or after leaving the Victoria Line

*App. F.* 28. The Table, *Appendix F,* shows the mode of transport (including walking) used by the Victoria Line passengers before entering or after leaving the Victoria Line ("trip end mode"), in terms of daily figures based on the May/June 1970 survey, the totals being identical with those shown in *App. C.* the third column of *Appendix C.* The table also shows the percentage increases of each figure, compared with the May/June 1969 survey, as well as the percentage distribution of the whole traffic over the different "trip end modes."

29. It will be seen that in May/June 1970, exactly 50 per cent. of all Victoria Line trip ends consisted of connecting rail journeys (29 per cent. Underground, 21 per cent. British Rail) whilst buses accounted for 7½ per cent, private cars for 1½ per cent., and "other modes, mainly walking" for the remaining 41 per cent. On the Undgeround the Piccadilly Line, with connections at Finsbury Park, Green Park and King's Cross in that order of importance, was the most important feeder and distributor to the Victoria Line (35,600 trip ends). But this is closely followed by the Northern Line with connections at Euston, King's Cross and Warren Street and (as regards the Highbury branch) at Highbury & Islington (32,600 trip ends) and by the District and Circle Line at Victoria and King's Cross (31,500 trip ends). The Central and Bakerloo Lines (at Oxford Circus) account for 26,900 and 26,000 trip ends, respectively. A further breakdown of these figures (not shown in the Table) reveals that, out of the total number of Underground trip ends (152,600), about 64,000 (42 per cent.) are accounted for by the "cross-platform" interchange facilities provided at four Victoria Line stations, viz.

| | |
|---|---|
| Oxford Circus (Bakerloo Line) | 23,200 |
| Euston (City branch of Northern Line) | approx. 15,500 |
| Highbury (Highbury branch of Northern Line) | 5,400 |
| Finsbury Park (Piccadilly Line) | 19,900 |
| | approx. 64,000 |

30. Out of the 109,400 British Rail trip ends, the majority (62,800 or 57 per cent.) are journeys from or to Victoria whilst King's Cross/St. Pancras accounts for 13,800 and Euston for 12,500. Next in order of importance are Seven Sisters (8,300), Finsbury Park (6,600), Tottenham Hale (2,700) and Walthamstow Central where the interchange with the Chingford Line accounts for 2,200 trip ends a day. There is also a small interchange movement from and to the North London Line at Highbury & Islington (500 trip ends). No rail trip ends were recorded at Blackhorse Road.

31. As far as road traffic feeders are concerned, the buses play an important part at Finsbury Park (15,000), followed by Walthamstow Central (7,200), Victoria (5,200), Seven Sisters (3,900), Highbury & Islington (2,000), Blackhorse Road (2,000), and King's Cross (1,600). Bus interchange at the remaining stations (including Oxford Circus) is insignificant.

32. "Park-and-ride" and "kiss-and-ride" are, of course, mainly concentrated at the suburban end of the line, with Walthamstow Central accounting for 2,200 trip ends, Blackhorse Road and Finsbury Park for 1,400 each, Highbury & Islington for 800, and Seven Sisters for 600. The figures for all other stations (including Tottenham Hale which has a station car park) are insignificant.

33. In contrast, walking to and from Victoria Line stations occurs, of course, mainly in the central area, with Oxford Circus (59,700) far and away in the lead, followed by Green Park (38,200), Victoria (32,100) and Warren Street (20,500).

34. It may also be of interest briefly to examine the percentage increases of some of these trip end figures between May/June 1969 and May/June 1970, i.e. by and large during the first year of operation to Victoria. Although the absolute numbers of trip ends by car and bus are still relatively small, they have shown the greatest overall percentage increases over the year (72 and 50 per cent., respectively). British Rail trip ends show an overall increase of 43 per cent., mainly due to an increase of 51 per cent. at Victoria. A similar percentage increase at Seven Sisters contrasts with a slight decrease at Tottenham Hale. Underground trip ends show an overall increase of 31 per cent., mainly due to an increase of 55 per cent. at Oxford Circus. An increase of 40 per cent. at Euston contrasts with a 20 per cent. drop at Warren Street which seems to be indicative of the fact that Northern Line passengers have only gradually become aware of the advantage of the cross-platform interchange facility at Euston between the Victoria Line and the City branch of the Northern Line.

### 3.9. Geographical spread of Victoria Line journeys

35. As has already been emphasized in paragraph 1, the Victoria Line – being the first new Underground railway to cross central London for over 60 years – was intended to improve travel conditions not only in the comparatively narrow strip directly served by the line but, by virtue of its multiple interchange facilities, over a large area of London. Since both the May/June 1969 survey and the May/June

1970 survey made use of individual "London Traffic Survey" zones or of judicicusly selected groups of such zones, the two surveys permit a verification of this claim through examinations of the geographical spread of trips using the Victoria Line for all or part of the journey.

36. Among the several geographical analyses of the survey results was a breakdown, based on the 1969 survey, of the origins and destinations of journeys to and from a group of survey zones broadly covering London's "West End". These journeys amounted to 112,000, representing 60 per cent. of the total of 186,000 daily trips on the Victoria Line, in May 1969. The percentage distribution of the origins and destinations of these West End trips was as follows:

| | |
|---|---|
| Local to the West End | 4 |
| Rest of Inner London | 19 |
| North-eastern suburbs directly served by Victoria Line | 17½ |
| | 40½ |
| Other north-eastern zones | 12 |
| Western zones | 14 |
| Southern zones | 29 |
| Other zones | 4½ |
| | 100 |

37. It will be noted that the inner areas and the north eastern suburban areas directly served by the Victoria Line jointly accounted for no more than about 40 per cent. of all Victoria Line journeys to or from the West End. The majority of West End journeys on the Victoria Line were, therefore, made from or to areas not directly served by the line, which is a further pointer to the contribution made by the Victoria Line to the general mobility of travel in London. An outstanding feature is the high share (29 per cent.) of passengers from or to the South – including 17½ per cent from or to Surrey or Sussex – most of whom travel via Victoria Station.

38. Another analysis, likewise based on the 1969 survey, was concerned with the geographical spread of trip ends other than by rail at the outer Victoria Line stations, from Walthamstow Central to Highbury & Islington, inclusive. The "catchment area" of these six stations stretches all the way from just north of King's Cross to zones north of Wood Green, Edmonton, Chingford and Woodford. Trips from or to the more remote zones are mainly "park-and ride" trips, but (as already mentioned in paragraph 31) the buses account for a very considerable feeder traffic to Finsbury Park, especially from the Muswell Hill area. The "indirect" suburban catchment area of the Victoria Line reached via connecting rail links, i.e. via the Piccadilly Line and the various connecting Eastern Region suburban lines in the north-east, has of course a considerably greater spread.

39. Yet another analysis, this time based on the 1970 survey, was concerned with the geographical spread of Victoria Line trips involving the use of other Underground lines or of British Railways which, as mentioned in paragraph 29, jointly accounted for 50 per cent. of all Victoria Line trips (262,000 out of 521,800 trip ends per day in 1970). In broad geographical terms, the percentage distribution of the non-Victoria Line terminal stations of the Victoria Line "rail trip ends" was as follows:

| | |
|---|---|
| *Central* London Underground stations, other than Victoria Line stations | 30 |
| Northern Line stations *north* of Euston | 7½ |
| Piccadilly Line and B.R. stations *north* of Finsbury Park, Seven Sisters, Tottenham Hale and Walthamstow Central | 15 |
| Underground and B.R. stations *west* of Earl's Court, Holland Park, Paddington and Baker Street. | 13 |
| Stations in the *south* mainly B.R. Southern Region, but including some traffic from and to Morden Line Underground stations | 33 |
| Underground and B.R. stations *east* of Liverpool Street. | 1½ |
| | 100 |

Again, the prominence of the Southern Region link (mainly at Victoria) is noteworthy.

### 3.10. Traffic distribution over periods of the day

40. *Appendix G* shows the numbers of passengers *entering* the Victoria Line platforms during different periods of the day in 1969 and 1970 respectively. It will be seen that, in round terms, each of the peak periods accounts for nearly one-third of the day's traffic, and that the traffic increase from 1969 to 1970 has been evenly spread over peak and off-peak. *App. G.*

### 3.11. Peak hour traffics

41. For assessing the usefulness and capacity requirements of an urban railway, even more important than the knowledge of two-way (daily or annual) traffic flows is a knowledge of one-way peak hour flows and their relationship to the daily flows, which varies not only with the incidence of off-peak traffic, but also with the degree to which peak hour flows from the two directions of the line overlap. The one-way peak hour traffic flows cannot, therefore, be directly deduced from the daily traffic flows. In order to obtain some data for one-way peak-hour traffic flows on the different sections of the Victoria Line, an attempt was made to work out, on the basis of the 1970 survey, the northbound and southbound flows on each section of the line between 08.30 and 09.30 hours and between 17.00 and 18.00 hours. However, because the true 60 minutes peak period varies slightly with the distance from the central area, the traffic flows thus obtained are lower than the actual peak 60 minutes flows which may, moreover, fluctuate significantly on different days, e.g. due to weather or traffic conditions. The "synthetic" peak hour flows obtained from the survey, therefore, understate the maximum 60 minutes traffic flows liable to be experienced on the line.

42. Subject to these important reservations, *Appendix H* shows the one-way peak hour traffic flows on each section of the Victoria Line as derived from the 1970 survey. It will be seen that the main direction of the a.m. peak flow is northbound from Victoria to Oxford Circus, and southbound from Walthamstow to Oxford Circus, though *App. H.*

between Oxford Circus and Green Park the southbound a.m. peak traffic is almost as heavy as the northbound. Similar conditions, though of course in the opposite direction, occur during the p.m. peak.

43. In terms of absolute numbers, the heaviest peak hour concentration was encountered during the southbound morning peak on the section from Euston to Warren Street (17,000 passengers), matched by a slightly lower concentration on the same section during the corresponding northbound peak hour in the evening (16,000). Between Victoria and Green Park, the northbound a.m. peak hour traffic flow (15,000) was virtually identical with the corresponding southbound p.m. peak hour flow (14,800). In each case, occasional observations of actual train loadings have shown somewhat heavier traffic flows during the peak 60 minutes periods. It may here be mentioned in passing that the priority rating of these two sections has changed since the opening of the Brixton extension which has, as expected, increased the traffic on the Victoria – Green Park section beyond that from and to the north.

44. It is also of interest to examine the varying relationship between the peak-hour one-way traffic flows and all-day traffic flows on the different sections of the line. The volume of peak-hour one-way traffic must normally be expected to be high, compared with the all-day two-way traffic, on outlying sections of the line where the peak-hour traffic is markedly undirectional and off-peak traffic comparatively light. On the other hand, this ratio of peak-hour one-way traffic to all-day two-way traffic must be expected to be low on in-town sections where the peak traffic flows from both directions tend to overlap and there is a high incidence of off-peak traffic. Thus, on the in-town section between Green Park and Oxford Circus, the heaviest one-way peak-hour flow amounts to no more than 8.7 per cent. of the total all-day two-way traffic (or 17.4 per cent. of the all-day one-way traffic). On the adjacent section between Green Park and Victoria, this ratio already rises to 12.2 per cent. of the all-day two-way traffic (24.4 per cent. of the all-day one-way traffic). On the northern "bottleneck" section between Euston and Warren Street, it rises to 14.3 per cent. of the all-day two-way traffic (28.6 per cent. of the all-day one-way traffic) and to over 20 per cent. of the all-day two-way traffic on the extreme section of the line from Blackhorse Road to Walthamstow Central where the northbound p.m. peak-hour flow (3,400) thus represents over 40 per cent. of the total all-day northbound traffic (8,400).

### 3.12. Journey purpose

45. The questionnaires also contained a question pertaining to the purpose of the journey. The predominance of the journeys between home and workplace was found to be so great that no attempt was made to prepare a detailed analysis of other journeys. In the May/June 1970 survey, the journeys between home and workplace accounted for 71 per cent. of all Victoria Line journeys, rising to 92 per cent. in the morning peak hour and 87 per cent. in the evening peak hour.

### 3.13. Build-up of traffic over time

46. One question of obvious interest in connection with the creation of new urban railway facilities is the time it takes for the traffic on the new line to build up. Between the May/June 1969 survey and the May/June 1970 survey, the daily traffic on the Victoria Line increased, as already stated, from 186,000 to 260,900, i.e. by 40 per cent., corresponding to a linear growth rate of 3.33 per cent. per month or a compound growth rate of nearly 3 per cent. per month.

47. However, in order to assess the degree to which the new facility has been able to attract traffic from other modes ("diverted traffic") and to generate new traffic ("generated traffic") – an assessment needed for the discussion, in the following chapter, of the effect of the new line on other lines and other modes – it is also necessary to estimate what may be termed the "natural turnover" in the patronage of the line, i.e. the numbers of "disappearing" passengers who, for purely personal reasons (e.g. because they have changed their home or job away from the line or because they have retired or died) cease to use the line irrespective of its attractions, and, on the other hand, the numbers of "newly appearing" passengers who, again for purely personal reasons (e.g. because they have moved into the area or changed their job) begin to use the line irrespective of any particular attraction. As will be seen presently the rate of this "natural turnover" is perhaps surprisingly high, yet extremely difficult to isolate from the other traffic categories, especially that of "generated traffic". The following attempt at quantifying the "turnover" must, therefore, of necessity, be based on a number of somewhat arbitrary assumptions and the results can merely be regarded as illustrative of the order of magnitude involved.

48. In the 1970 questionnaire, "regular" passengers (i.e. passengers using the Victoria Line at least once a week) were asked when they first started to use the Victoria Line for their particular journey. As the "regular" passengers amounted to 213,900 (82 per cent.) out of the total of 260,900 daily passengers, it would seem permissible to assume a similar trend for the total traffic. From an interpolation of the near-linear trend curve, it appears that no more than about 100,000 (38 per cent.) out of the total of 260,900 passengers in May/June 1970 had already used the line in May/June 1969 so that the remaining 86,000 among the 186,000 passengers in May/June 1969 (i.e. no less than 46 per cent. of the latter), appear to have been replaced during the year.

49. Somer further relevant information can be gleaned from the answers to another question in the 1970 questionaire where passengers who never made the same journey before beginning to use the Victoria Line were asked whether this was because their present journey was prompted by the existence of the Victoria Line or for some other reason, e.g. because they lived somewhere else, etc. This question is admittedly difficult to answer without expert guidance, as there must be many marginal cases; but if the answers can be accepted at face value, then no fewer than 102,900 (39 per cent.) out of 260,900 passengers using the Victoria Line in May 1970 did so because of a change in personal circumstances rather than as a direct result of the advent of the Victoria Line.

50. It can perhaps be argued that, in the absence of any major changes in circumstances, the rate of "natural turnover" might be expected to balance i.e. the number of passengers "disappearing" for personal reasons might be expected to be roughly balanced by the number of "newly appearing" passengers "inheriting" their homes and jobs. As, on the other hand, the number of "disappearing" passengers (86,000 since May/June 1969) is matched by a *greater* number of passengers – other than those expressly identified as coming under the categories of "generated" or

"diverted" traffics – "newly appearing" in May/June 1970 (102,900), it could be further argued that the excess of 16,900 could be ascribed to the "indirect" traffic-generating effect of the Victoria Line in promoting a greater concentration of traffic attractions, and should, therefore, be added to the category of "generated" traffic already identified from passengers' response. In the absence of any other suitable method, this admittedly somewhat vague approach has been used in the following analysis of "generated" and "diverted" traffic.

### 3.14. "Diverted" and "generated" traffic

51. The evaluation of the answers to the 1969 and 1970 questionnaires yielded the following primary classification of the total daily numbers of journeys:

| | May/June 1969 | May/June 1970 |
|---|---|---|
| Diverted from rail and mixed modes | 111,400 (60) (100) | 122,000 (47) (110) |
| Diverted from bus only | 12,200 (7) (100) | 14,700 (6) (120) |
| Diverted from car only | 2,000 (1) (100) | 3,700 (1) (185) |
| Generated | 10,000 (5) (100) | 17,600 (7) (176) |
| "Residual" | 50,400 (27) (100) | 102,900 (39) (204) |
| Totals | 186,000 (100) (100) | 260,900 (100) (140) |

(This table shows "raw data" which are superseded by those shown in the table below).
Here, the term "residual" is used for those journeys, referred to in the previous paragraphs, which could not have been made before because of a change in personal circumstances.

52. As explained in paragraphs 49 and 50, the number of 102,900 "residual" journeys in May/June 1970 should first be reduced by 16,900 which could be taken to represent the "indirect" traffic generating effect of the Victoria Line and should be added to the category of "generated" traffic, raising the latter to 34,500 and reducing the "residual" traffic to 86,000. It can then be argued that, since these 86,000 passengers can be regarded as "stand-ins" for the earlier passengers who disappeared since May 1970, they should be assigned to the different categories of "generated" and "diverted" traffic in the same proportions as the passengers already clearly identified as such. As regards the 50,400 "residual" passengers in May/June 1969 (when the line had only been open for about three months), a transfer to the category of "generated" traffic can hardly be justified; but the total should again be allocated "pro rata" to the other categories. This finally results in the following revised classification:

| | May/June 1969 | May/June 1970 |
|---|---|---|
| Diverted from rail and mixed modes | 152,800 (82) (100) | 182,000 (69½) (119) |
| Diverted from bus only | 16,800 (9) (100) | 21,900 (8½) (130) |
| Diverted from car only | 2,700 (1½) (100) | 5,500 (2) (204) |
| Total "diverted" traffic | 172,300 (92½) (100) | 209,400 (80) (123) |
| "Generated" traffic | 13,700 (7½) (100) | 51,500 (20) (375) |
| Totals | 186,000 (100) (100) | 260,900 (100) (140) |

53. On the strength of these figures, 80 per cent. of the traffic using the Victoria Line in May/June 1970 thus consisted of "diverted" traffic and 20 per cent. of "generated" traffic. It must, however, be emphasised again that this method of estimating the "generated" traffic is, of necessity, somewhat arbitrary and may err on the generous side. As a rough guide, derived from a sensitivity test, the figure of 20 per cent. would decrease (or increase) by ½ per cent. for every reduction (or increase) of 1,000 in the figure of "indirectly generated" traffic (16,900), dropping to about 11 per cent. in the most "pessimistic" case that none of the 16,900 trips are regarded as "generated". But in any case, as might be expected, the traffic diverted from rail and bus tended to migrate to the Victoria Line earlier and, therefore, showed less growth over the year whilst "generated" traffic and traffic diverted from cars took longer to develop and, therefore, showed considerable percentage rises which are, moreover, still likely to continue. The "diverted" traffic, are analysed in the next chapter, dealing with the effect of the Victoria Line on other Underground lines and other modes.

## 4. EFFECT OF VICTORIA LINE ON OTHER LINES AND MODES

### 4.1 Before-and-after matrix of diverted traffic

54. The table, *Appendix J,* shows how the 209,400 "diverted" passengers (who represent 80 per cent. of the total daily traffic in May/June 1970) travelled before and after the advent of the Victoria Line. It will be seen from this "before-and-after matrix" that nearly one-third (67,900) of these journeys used the Underground only, and that these included 12,100 journeys previously made exclusively by bus, 6,900 partly by bus, 4,300 wholly or partly by British Railways, and 1,900 wholly or partly by private car. Among the 59,500 "after" journeys representing combinations of British Railways and Underground journeys (28 per cent. of all diverted journeys), 7,600 had not used British Railways before and can, therefore, be regarded as having been induced to British Railways by the Victoria Line; this is, of course, apart from any "generated" journeys which might also affect British Railways. *App. J.*
The extent of relief afforded by these journeys to the roads is indicated by the fact that 15,400 of them were previously made wholly or partly by bus, and 1,800 wholly or partly by car.

55. On the other hand, the numbers of "after" journeys consisting of a combination of bus and rail journeys, totalling 50,400 (24 per cent. of all "diverted" journeys), include 6,100 journeys which had not involved the buses before. Similarly, the 32,000 "after" journeys (15 per cent. of all "diverted" journeys) consisting of a combination of car and rail journeys include 4,900 journeys which had not involved the private car before. In 1,400 cases, however, "car only" journeys had become "park-and-ride" or "kiss-and-ride" journeys.

56. The net effects of all these diversions on the separate modes of transport are as follows:

(NB: Figures extracted from Appendix J)

| | Total number of diverted journeys | | |
|---|---|---|---|
| | Before | After | Net increase (+) or decrease (–) |
| Car only | 5,500 | – | – 5,500 |
| Car plus other modes | 27,000 | 32,000 | + 5,000 |
| Total, car | 32,500 | 32,000 | – 500 |
| Bus only | 21,900 | – | – 21,900 |
| Bus plus other modes | 62,700 | 50,400 | – 12,300 |
| Total, bus | 84,600 | 50,400 | – 34,200 |
| British Railways only | 3,200 | – | – 3,200 |
| B.R. plus other modes | 91,700 | 97,200 | + 5,500 |
| Total, B.R. | 94,900 | 97,200 | + 2,300 |
| Underground only | 49,400 | 67,900 | + 18,500 |
| Underground plus other modes | 109,200 | 141,500 | + 32,300 |
| Total, Underground | 158,600 | 209,400 | + 50,800 |

57. It will be seen that 5,500 "car only" journeys (representing approximately 4,000 vehicle trips) have been eliminated whilst 5,000 additional "park-and-ride" or "kiss-and-ride" person trips (which are of course over much shorter distances and normally affect less congested areas) have been induced. The net reduction in bus passenger trips amounts to 34,200 representing 40 per cent. of the "before" total of 84,600 (compared with a drop of 5½ per cent. in the total annual number of bus passengers from 1969 to 1970. British Railways have lost 3,200 "through" trips but have gained 5,500 feeder or distributor journeys. The total number of journeys diverted to the Underground amounts to 50,800. All these figures, it may be recalled, are in terms of passenger journeys; the losses and gains in terms of passenger miles would be substantially different. Also, the figures do not include traffic "generated" by the Victoria Line which also affects the connecting lines and modes.

### 4.2. Effect of the Victoria Line on other Underground lines.

58. The most comprehensive and consistent basis for assessing the effect of the Victoria Line on specific sections of other Underground lines and, for that matter, of British Railways is provided by comparing the numbers of Victoria Line passengers who used these sections in May/June 1970 with those numbers among them who used the same sections before the advent of the Victoria Line. However, in order to take into account those "before" passengers who, but for a change in their personal circumstances, would have been among the Victoria Line passengers in May/June 1970, the "before" figures must be grossed up by the May/June 1970 ratio of total and (total, less "residual") traffic, i.e. by a factor of $\frac{100}{100 - 39} = 1.64$.

In view of the magnitude of this factor and the uncertainty as to whether it is in fact equally applicable to all sections of the railway network, the individual results summarised for selected sections of the railway network in *Appendix K* and shown in Map II can only be taken to indicate the likely order of magnitude of the changes brought about by the Victoria Line. The figures are indicative of the total direct effect of the Victoria Line, i.e. they represent the net effect of traffic diversion and traffic inducement created by the Victoria Line. But, being derived from interrogation of Victoria Line passengers, they cannot include any additional traffic on pre-existing railway sections which, having been relieved by the Victoria Line, may ipso facto have attracted some additional traffic not using the Victoria Line.

*App. K.*

59. A brief commentary on these figures, using the annual increases and decreases as the most convenient basis, may be of interest. As expected, the greatest measure of relief was experienced on certain sections of the District and Piccadilly Lines. On the former, the diversion to the Victoria Line of traffic between Victoria and the West End, Euston and King's Cross resulted in considerable relief on the sections between Victoria and Charing Cross, with a maximum decrease of 13.2 million passengers per annum between Westminster and Charing Cross and a minimum decrease of 8.2 m. passengers p.a. between Victoria and St. James's Park where the relief effect is partly counteracted by a reverse traffic flow set up by the Victoria Line. West of Victoria, i.e. outside the critical section of the District Line, the Victoria Line had the net effect of inducing additional traffic to the tune of 1.6 m. passengers p.a. between Victoria and Sloane Square. East of Charing Cross, a relief effect of the order of 2 to 3 m. passengers p.a. extends all the way along the Circle Line to Liverpool Street, mostly representing traffic from and to the north-eastern suburbs previously flowing via Liverpool Street and now diverted to the Victoria Line (for the effect on the north side of the Circle Line, see paragraph 64).

60. On the Piccadilly Line, the Victoria Line has afforded considerable relief all the way between Finsbury Park and Green Park and, in particular, on the heavily used section between Finsbury Park and Holborn where the Piccadilly Line loadings have been reduced by between 12 and 13 m. passengers p.a. Even west of Green Park, there has been some relief to the Piccadilly Line of the order of 1½ m. passengers p.a. all the way to South Kensington, presumably mainly because West London passengers to and from Oxford Circus prefer the easier interchange with the District Line at Victoria to the one with the Piccadilly Line at Green Park North of Finsbury Park, the relief effect on the Piccadilly Line is partly offset by new traffic generated by the Victoria Line via the easy cross-platform interchange at Finsbury Park.

61. Next in order of magnitude comes the relief effect of the Victoria Line on the West End section of the Northern Line between Euston and Charing Cross, with a maximum of 10.6 m. passengers p.a. between Goodge Street and Tottenham Court Road. North of Euston, a relief effect of the order of just over 1 m. passengers p.a. extends all the way from Highgate, because of the counter-attraction of the Victoria Line at Finsbury Park and its bus feeder from the Muswell Hill area. Superimposed on this effect is a shift of traffic of the order of 1½ m. passengers p.a. from the West End to the City trains north of Euston, due to the cross-platform interchange facility at Euston between the Victoria Line and the City section of the Northern Line which was in fact designed with this purpose in mind. East of Euston, traffic on the City section of the Northern Line has been reduced by between 1½ and 2 m. passengers p.a., mainly as a result of a switch of Southern Region traffic from London Bridge to Victoria (see paragraph 69 below), although the "bottleneck" section of the Northern Line immediately north of London Bridge still remained overcrowded. Presumably because of a similar switch to Victoria there has also been a very desirable relief to the Northern Line through Waterloo (2m. passengers p.a.).

62. On the Bakerloo Line, the Victoria Line had the

expected effect of providing considerable relief between Oxford Circus and Charing Cross (5.9 m. passengers p.a. just south of Oxford Circus), but increasing the load on the critical section between Baker Street and Oxford Circus (1.4 m. passengers p.a.).

63. On the Central Line, the Victoria Line has brought some relief to the eastern sections of the order of ½ m. passengers p.a. north of Leyton, about 1 m. passengers p.a. between Leyton and Liverpool Street, rising to 3.7 m. passengers p.a. on the critical section between Liverpool Street and Bank and to 5.5 m. passengers p.a. between Tottenham Court Road and Oxford Circus. West of Oxford Circus, on the other hand, the Victoria Line has induced some additional traffic, of the order of 1 m. passengers p.a., all the way to Lancaster Gate.

64. On the Metropolitan and Circle Lines, finally, the Victoria Line has brought some relief all the way between Gloucester Road and Liverpool Street, with a maximum of 2.3 m. passengers p.a. between King's Cross and Euston Square.

*App. K.* 65. The data given in *Appendix K* relate to all-day and corresponding all-year two-way traffics. A corresponding evaluation of the effect of the Victoria Line on one-way peak-hour traffics would have been difficult, if only because of the time lags in the 60-minutes peak period on different sections of the network. It was hoped that some idea of the effect of the Victoria Line on one-way peak-hour traffics on other sections of the Underground could be gained from "before-and-after" train loading observations. By their very nature, however, such observations are liable to be affected by a high degree of error (a difference of, say, 3 passengers per car is equivalent to a difference of some 700 passengers per hour). Moreover, inasmuch as many of these observations were taken on a single day only, they are bound to show considerable fluctuations due to random influences (e.g. the weather). In the event, a detailed comparison of "before-and after" loading observations yielded no more than a broad confirmation of the trends discussed above, without providing much useful additional information.

### 4.3. Effect of the Victoria Line on British Railways suburban lines

*App. K.* 66. The table, *Appendix K* already referred to in the preceding chapter also contains data, from the 1970 survey, pertaining to the effect of the Victoria Line on the traffic of British Railways suburban lines. The lines most directly affected are, of course, those in North-East London where the Victoria Line provides a new facility not only direct to Oxford Circus and Victoria but also, by virtue of a series of convenient cross-platform interchange facilities at Finsbury Park, Highbury & Islington and Oxford Circus, to many other destinations in the central area.

67. As far as the Eastern Region lines into Liverpool Street are concerned, the total annual volume of traffic diverted to the Victoria Line amounted, according to the May 1970 survey, to 6.8 m. passengers p.a., 3.8 m, passengers p.a. via Clapton and 3.0 m. passengers p.a. via Stamford Hill. North of the interchange stations with the Victoria Line, this traffic diversion was counteracted by induced and generated traffic. Even so, perhaps partly due to increased "park-and-ride" and partly to bus reshaping schemes introduced at about the same time as the Victoria Line, there was in May/June 1970 a slight net traffic decrease of the order of ½ m. passengers p.a., both on the Chingford Line and on the Enfield Town Line. Further west, the Great Northern suburban lines north of Finsbury Park suffered a similar loss as far as Wood Green whilst the loss between Finsbury Park and King's Cross was nearly 1 m. passengers p.a. In contrast, the Victoria Line induced a slight traffic increase on the Bishop's Stortford Line north of Tottenham Hale (0.4 m. passengers p.a.). However, the results for the Enfield Line north of Seven Sisters and for the Bishop's Stortford Line north of Tottenham Hale are probably also affected by routing and timetable changes on the Eastern Region.

68. In contrast to the Eastern Region suburban lines from which traffic was mainly abstracted by the Victoria Line, the London Midland Region suburban lines terminating at St. Pancras and Euston have, as expected, benefited from the improved in-town distribution facilities offered by the Victoria Line at these terminals. According to the 1970 survey, the increase at St. Pancras was of the order of 0.8 m. passengers p.a. and that on the d.c. lines at Euston of the order of 0.5 m. passengers p.a., the latter being at the expense of the Bakerloo link at Queen's Park. Again, however, these results are probably also affected by other factors, especially at Euston (see paragraph 73).

69. A particularly interesting effect of the Victoria Line has been the shift of traffic, accentuated by "generated" traffic, on the Southern Region from other terminals to Victoria. According to the 1970 survey, the Victoria Line has added 6.0. m. passengers p.a. at Victoria, only partly offset by a loss of 2.4 m. passengers p.a. at London Bridge (including 0.8 m. passengers p.a. at Charing Cross) and 1.0 m. passengers p.a. at Waterloo. The latter decrease is also reflected in a relief to the Waterloo and City Line of the order of 0.3. m. passengers p.a.

70. It is obvious interest to compare these findings from the May/June 1970 survey with the relevant "before-and-after" train loading observations taken by British Railways. Inasmuch as these observations are based on counts of passengers boarding and alighting, e.g. at the London terminals, they should be more reliable than observations of loaded trains, but most of these observations are based on single counts and are, therefore, liable to be affected by random fluctuations of traffic. Moreover, it must obviously be kept in mind that the comparisons as between one year and the next may well be impaired by other trends, including those of a localized character, such as recent electrification schemes effecting the terminus concerned. In addition, the comparability of these data with the May/June surveys is impaired by the fact that most of British Railways' routine observations take place in October or November so that the differences between May/June and October/November may already reflect a trend. It is with these provisos in mind that the following British Railways data should be assessed.

71. A case in point is provided by the Southern Region counts of the daily numbers of passengers arriving and departing at their London terminals. Here, again, the effect of the Victoria Line on the Southern Region traffic at Victoria is of special interest. Here, a comparison between the counts in October 1968 and October 1970 is unfortunately impaired by an apparently "freakish" low figure in 1968 (174,000), out of keeping with the general trend. If this figure is replaced by an interpolation between the October 1967 and October 1969 figures resulting in 187,000 and then compared with the October 1970 figure of 201,000, the increase of 14,000 between "1968" and 1970 would correspond to an increase of about 4½ m. in terms of annual

traffic, compared with about 6 m. passengers p.a. indicated by the May 1970 Victoria Line survey. Similar agreement between the two sets of data exists at London Bridge where the total daily number of passengers arriving and departing in all Southern Region trains has, according to the South ern Region counts, dropped slightly from 348,000 in October/November 1968 to 341,000 in October/November 1970, i.e. by 7,000 per day or about 2.2 m. passengers p.a. compared with the May 1970 survey figure of 2.4 m. At Waterloo, on the other hand, the Southern Region autumn 1970 counts show an increase over the autumn 1968 counts of 6,400 per day, corresponding to 2 m passengers p.a. whilst the Victoria Line survey in May/June 1970 indicated a decrease of the order of 1 m. passengers per annum A possible explanation is that the relief effect of the Victoria Line has been outweighed by the continuing traffic increase due to the Bournemouth electrification and the service improvements on the Portsmouth line.

72. Turning now to the Eastern Region, the observations of passengers arriving and departing on the "West Side" trains at Liverpool Street show a drop from 71,000 in October/November 1968 to 57,000 in October/November 1970, i.e. a drop of 14,000, corresponding to about 4½ m. passengers p.a., compared with 6.8 m. passengers p.a acc-ording to the Victoria Line survey. In contrast, counts of peak traffic (a.m. arrivals and p.m. departures) on the suburban trains at King's Cross would seem to indicate a much greater annual loss (about 3 m. passengers p.a.) than that indicated by the Victoria Line survey (about 1 m. passengers p.a.).

73. On the London Midland Region suburban lines, the peak traffic counts indicate an increase of the order of 1 m. passengers p.a. at St. Pancras, compared with the survey figure of 0.8 m. passengers p.a. but a much greater increase of the order of 2½ m. passengers p.a. at Euston where the Victoria Line survey had only indicated a marginal increase of about 0.5 m. passengers p.a. Here the bulk of the traffic increase has obviously been due to other reasons, presumably the continued attraction of the a.c. electification.

### 4.4. Effect of the Victoria Line on bus traffics

74. Whilst the overall effect of the Victoria Line on bus traffics have already been discussed in previous chapters, it is more difficult to single out the effect on specific bus routes. Apart from the generally falling trend in bus traffics, there have also been changes in the pattern of bus services in the area, mainly but not wholly as a result of the advent of the Victoria Line, and those changes would in them-selves account for variations in the patterns of bus passenger journeys. Finally, as far as bus loading observations are con-cerned, these are obviously prone to undergo day-to-day random fluctuations.

75. Even so, some relevant data are at hand. For example, there was a 16 per cent. loss of bus traffic arriving at Fins-bury Park from the Manor House direction (i.e. parallel to the Victoria Line), compared with an increase of 3 per cent. from Hornsey, 41 per cent. from Crouch End and 42 per cent. from Hornsey Rise (i.e. on the feeder bus routes). At Manor House, there were losses of 63 and 8 per cent. in bus traffic from the directions of Seven Sisters and Amhurst Park, respectively, i.e. essentially parallel to the Victoria Line. There were also considerable losses in bus traffic, followed in due course by reductions in the services, along Lea Bridge Road, Camden Road and Hertford Road. In the central area, the numbers of bus passengers arriving at Victoria from Oxford Circus and Green Park dropped, initially, by about one-third, whilst the numbers of bus passengers set down by northbound buses at Warren Street from Oxford Circus or Victoria dropped by one-fifth.

### 4.5. Effect of the Victoria Line on other road traffic

76. As already stated in paragraph 57, the Victoria Line is believed – by the time of the May/June 1970 survey – to have eliminated about 5,500 "car only" or "main mode" person trips a day, corresponding to roundly 4,000 vehicle trips a day. Because of the general upward trend of traffic by private car, and because of the wide dispersion of that traffic, a corroboration of this figure by road traffic counts is difficult to obtain. Vehicle counts by means of auto-matic counters, taken by the Greater London Council on a "screenline" along the River Lee and across the major routes from North East to Central London, showed virtually identical "before-and-after" one-way traffic flows (app-roximately 42,000 vehicles between 07.00 and 10.00 hours, and approximately 202,000 all day) over a period of one year from 1968 to 1969 during which motor traffic in general increased by about 6 per cent. Counts carried out by London Transport, as an annual routine, of private cars entering central London during the morning peak period across the "Inner Cordon" of the central area (as defined in the Report of the London and Home Counties Traffic Advisory Committee on London Traffic Congestion, 1951) showed, in the north-east sector potentially affected by the Victoria Line, a decline from 11,357 cars in July 1968 to 9,289 in July 1969 (the Victoria Line was opened to Warren Street in December 1968 and to Victoria in March 1969). This decline of 2,068 (18 per cent.) represents the bulk of a decline of 2,200 (from 73,500 to 71,300 i.e. by 3 per cent.) in the total number of private cars entering central London during the morning peak period, implying a virtual stagnation of car traffic from other areas. These figures are also broadly compatible with the elimination of 4,000 "main mode" vehicle trips per day (i.e. 2,000 trips per day each way) shown by the Victoria Line survey.

77. Some interest is also attached to the results of "before-and-after" counts, carried out by the G.L.C. and Westmin-ster City Council, of the northbound flow of pedestrian traffic across Constitution Hill outside Buckingham Palace during the morning peak (08.15 to 09.45 hours) when con-siderable numbers of suburban commuters from Victoria used to walk across to Mayfair, especially in good weather. These counts showed a significant drop from about 1,900 just before the opening of the Victoria Line in March 1969 to about 1,000 just after that event, and to about 1,250 in mid-summer (15th July 1969). Such pedestrian traffic flows are, of course, liable to be effected not only by the weather but also by changes in the fares structure.

## 5. COMPARISON OF TRAFFIC RESULTS WITH FORECASTS

### 5.1. Forecasts of total annual passenger mileage on the Victoria Line

78. Not only for academic reasons but also in order to assess the validity of the forecasting methods in their app-lication to other projects – e.g. the Fleet Line – it is of obvious interest to compare the survey results with the various forecasts of Victoria Line traffics, made in the course of the years. It will be recalled from paragraphs 19 and 20 that the total annual passenger mileage on the Vic-toria Line in May/June 1969 (165 million) came very close to the estimate prepared immediately before the opening

of the line to Victoria (169 million). The traffic continued to rise, reaching a rate of 229 m. passenger miles p.a. by May/June 1970 – a figure which exceeds the 1969 forecast by 35 per cent. and comes close to the 1955 estimate of 250 m. passengers p.a. if allowance is made for the fact that the latter applied to a longer line with an additional station at Walthamstow (Wood Street). If, in addition, the Great Northern electrification had been in operation in 1970 as anticipated in 1968, the total annual passenger mileage on the Victoria Line north of Victoria would probably have come close to, or even exceeded, the 263 m. predicted in 1958.

79. There are, however, some reasons why a straight comparison of the forecasts and survey results for the total annual passenger mileage could be somewhat misleading.
For example, whilst the survey results can be regarded as reasonably representative of actual traffic on the line, the forecasts of diverted season ticket journeys, which represent a significant proportion of the predicted total traffic, had to be based on the assumption that the season ticket would be used twice a weekday between the stations of origin and destination for which it was valid and could not include any additional unrecorded "short" journeys made by the ticket holder ("free of charge") during the day so that the comparisons would be vitiated to that extent. Moreover, the comparisons must be expected to conceal greater differences between forecast and survey results in respect of the geographical spread of traffic over the line and its composition in terms of "generated" and different categories of "diverted" traffics. The geographical spread over the line is most readily expressed in terms of annual traffic densities (i.e. total numbers of passengers, both directions together) on each section of the line.

### 5.2. Forecasts of annual traffic densities on the Victoria Line

*App. L.* 80. *Appendix L*, compares the total annual densities on each section of the line as forecast

- in 1955 in a submission to the British Transport Commission for the Parliamentary evidence,
- in 1958 and published in 1959 in the "Report by the London Travel Committee to the Minister of Transport and Civil Aviation" on "The Victoria Line", and
- in early 1969 just before the line was opened to Victoria,

with densities actually calculated from the May/June 1969 and May/June 1970 surveys. It is relevant to recall once more that the 1955 and 1958 estimates applied to a line with one additional station which would add to the passenger mileage not only on the extreme end but all the way to the central area. The table also repeats, for each column, the total annual passenger mileage (which is, of course, not the sum of the sectional densities but the sum of their products with the sectional route mileages).

81. It will be seen that, in all the forecasts, the annual two-way traffic on the two southern sections of the line between Victoria and Oxford Circus had been consistently under-estimated compared with the annual equivalent of traffic actually resulting in May/June 1970, though this does not apply to the May/June 1969 results. On the main section of the line between Oxford Circus and Finsbury Park, the actual densities in May/June 1969 came very close to the early 1969 estimates whilst the actual densities in May/June 1970 were a good deal higher, coming close to the 1955 predictions. Traffic on the sections north of Finsbury Park came close to the early 1969 estimates but fell far short of the 1955 and 1958 estimates, even allowing for the fact that these were prepared for a longer line.

82. The consistent under-estimation of the annual traffic densities south of Oxford Circus appears to be partly due to an unexpectedly great transfer to Victoria of Southern Region traffic from other terminals, possibly representing an acceleration of a general long-term shift of central area traffic towards the West End. Another contributory factor appears to be the relatively inconvenient interchange facility at Green Park which seems to have induced many West London passengers to change at Victoria instead, so using the Victoria Line over a longer distance; it was in fact found from the 1970 survey that, on average, 59 per cent. of all passengers travelling between Earl's Court/Gloucester Road/South Kensington and Victoria Line stations Oxford Circus to Walthamstow Central travelled via Victoria, and only 41 per cent. via Green Park although the average overall journey time via Green Park is marginally shorter. Finally, the Victoria-Oxford Circus section also seems to have attracted an unexpectedly heavy volume of short-distance "generated" traffic, especially during the day; this would, incidentally explain why, in contrast to the annual two-way traffic which was 28 per cent. above the 1955 forecast, the one-way peak-hour traffic on the section from Green Park was, in May/June 1970, no more than 7 per cent. above the 1955 forecast (see below).

### 5.3. Forecasts of one-way peak-hour traffics on, from and to the Victoria Line

83. Mainly in order to assess the capacity requirements for the Victoria Line, i.e. the physical dimensions of subways, booking office facilities, peak hour train services, etc., estimates were also prepared at the time of the Parliamentary procedure in 1955 and again in early 1969 of the one-way peak-hour traffic flows on the Victoria Line and (in 1969) also of peak hour interchange traffics between the Victoria Line and other Underground lines. Since these peak traffic estimates had to be based on further assumptions about the ratios of one-way peak-hour and two-way annual traffics – a ratio which, as explained in paragraph 44, varies greatly with the geographical location of the section of line concerned – these estimates must be expected to be less accurate than those of annual two-way traffics. With this reservation, the 1955 and 1969 forecasts can be compared with the results of the 1970 survey in respect of passengers using the line between 17.00 and 18.00 hours (cf. paragraph 41).

84. It will be seen from *Appendix M.* that, on the critical section from Green Park to Victoria, the southbound traffic between 17.00 and 18.00 hours derived from the 1970 survey, amounting to 15,000 passengers, was 1,000 (7 per cent.) in excess of the traffic anticipated in 1955 whilst the 1969 estimate of 12,600, though not far below the train loadings observed a few months after the line was opened to Victoria, was soon exceeded. On the northern side, the 1970 traffics were, on the sections as far as Finsbury Park, in quite good agreement with the 1955 forecasts whilst on the sections north of Finsbury Park (for which no peak hour forecasts had been recorded in 1955), there is reasonably good agreement with the 1969 forecasts. *App. M.*

85. Some interest may also be attached to a comparison of certain important interchange traffic flows during the p.m. peak hour in 1970 with the corresponding forecasts made early in 1969. This comparison is made in *Appendix N.* It will be seen that, with one important exception referred to below, the forecasts may be said to have come reasonably close to the actual 1970 traffics, considering the numerous assumptions which had to be embodied in the forecasts. *App. N*

The one important exception is the interchange traffic from the Highbury branch of the Northern Line to the Victoria Line at Highbury & Islington which, like the traffic on that branch itself (see following chapter), had in 1970 inexplicably fallen far below the expectations and, indeed below the traffic experienced in May/June 1969 after the Victoria Line in the north had already been in operation for some time.

### 5.4. Forecasts of the effect of the Victoria Line on the annual traffic densities on some sections of other Underground lines

86. Again in terms of annual densities, a comparison between the early 1969 predictions and the 1969 and 1970 survey results of the effects of the Victoria Line on selected sections of the Underground network gives rise to the following comments.

87. Comparisons between the 1969 predictions and the results of the May/June 1969 survey show that the relief effect was fairly consistently under-estimated. On the District line between Victoria and St. James's Park, for instance, the forecast drop of 5.6 m. passengers p.a. compares with an actual drop of 6.2 m. On the Piccadilly Line between Russell Square and King's Cross the predicted drop of 7.0 m. compares with an actual drop of 8.4 m. p.a.; between Green Park and Piccadilly Circus, a drop of 6.2 m. p.a. compares with a forecast of 5.5 m. On the Northern Line between Warren Street and Goodge Street, the actual drop of 6.7 m. p.a. compares with a 5.0 m. forecast. On the Central Line between Bank and Liverpool Street, the difference was between a predicted decrease of 2.6 m. p.a. and an actual decrease of 3.8 m. Further east on the Central Line, e.g. between Stratford and Leyton, where the relief effect exerted by the Victoria Line had originally (in 1955) been estimated at broadly 1 m. passengers p.a. the early 1969 forecast of 0.8 m. p.a. compares with a 1969 survey figure of 0.7 m. p.a. and a 1970 survey figure of 1.2m. p.a.

88. On the other hand, some of the forecast *in*creases of traffic on other Underground lines, induced by the Victoria Line, were over-estimated. On the Bakerloo Line between Baker Street and Regents Park, for instance, the 1955 forecast of roundly 2 m. passengers p.a. and the early 1969 forecast of 2½ m. compare with an actual increase of 1.0 m. in May/June 1969 and 1.4 m. in May/June 1970. On the Central Line between Bond Street and Oxford Circus, the forecast increase of 0.8 m. passengers p.a. due to the stimulation effect of the Victoria Line compares with an actual increase of 0.6 m. by May/June 1969, rising to 0.9 m. by May/June 1970.

89. One fortunately quite exceptional case of unfulfilled expectations concerns the Highbury branch of the Northern Line ("Northern City Line") where traffic has decreased very considerably over the years, partly perhaps because of a general shift of traffic away from the City to the West End but mainly because, in consequence of the postponement of the Great Northern electrification scheme, the link between Drayton Park and Finsbury Park had to be interrupted for several years during the construction of the Victoria Line resulting in a wholesale diversion of traffic to other rail routes, e.g. via King's Cross or Broad Street, as well as in a heavy permanent loss of traffic. In 1955, when the first forecast of an increase of 5 m. passengers p.a. on the key section between Highbury and Essex Road was made this section had an annual traffic of 8 m. which dropped to 7 m. before the cutback and to 3 m. during the cutback. In consequence the predicted increase was reduced to 1.1 m. passengers p.a. in the early 1969 forecast. But even this figure was not quite reached in the 1969 survey (0.9 m. passengers p.a.), and then dwindled still further to a mere 0.2 m. according to the 1970 survey. It is, however, not unlikely that this trend will be halted or reversed when the present service is replaced by the much more frequent service of Great Northern suburban trains.

### 5.5. Forecasts of the effect of the Victoria Line on British Railways

90. If the changes, forecast in early 1969, in annual densities on British Railways' lines effected by the Victoria Line are compared with the figures derived from the 1969 and 1970 surveys, it must again be admitted that – like the diversions from other Underground lines – the Victoria Line effect had been fairly consistently underestimated.

91. The outstanding example, though unique in its magnitude, is that of Victoria where (an admittedly very "rough") forecast had anticipated an increase in Southern Region traffic of no more than about ½ m. passengers p.a. whilst the May/June 1969 survey indicated an increase of 2.1 m. and the May/June 1970 survey one of 6.0 m. (compared with about 4½ m. as derived from an interpretation of passenger counts, see paragraph 71). Among the possible explanations for this great increase in Southern Region traffic at Victoria are (i) the introduction of the inter-availability of Southern Region tickets between their London terminals which facilitated the switch of commuters from other terminals to Victoria to a much greater extent than could be foreseen at the time and (ii) an unexpectedly great traffic-generating effect of the Victoria Line link with the West End which would also be in line with the unexpectedly high annual density of traffic experienced on the Victoria Line between Victoria and Oxford Circus (cf. paragraph 82).

92. As far as other Southern Region terminals are concerned, the drop of 0.7 m. passengers p.a. on the approach lines to London Bridge forecast in early 1969, turned out to be 1.3 m. in May/June 1969. 2.4 m. in May/June 1970, and 2.2 m. according to the Southern Region count in October or Novermber 1970. The share of Charing Cross traffic, included in these figures, amounts to 0.3 m. passengers p.a. predicted, 0.4 m. derived from the 1969 survey, and 0.8 m. according to the 1970 survey. At Waterloo, a predicted slight diversion to Victoria of 0.1 m. passengers p.a. was found to be at the rate of 0.6 m. in May/June 1969 and of 1.0 m. in May/June 1970 although, as already mentioned (in paragraph 71), traffic at Waterloo has in fact – for reasons unconnected with the Victoria Line – gone *up* between autumn 1968 and autumn 1970 at the annual rate of 2 m.

93. In the early 1969 forecast, there has also been an underestimate of the diversion to the Victoria Line of Eastern Region traffic previously travelling via Liverpool Street where the forecast of 3.8 m. passengers p.a. compares with 5.3 m. according to the 1969 survey and 6.8 m. according to the 1970 survey although, as already mentioned (in paragraph 72), a comparison of the 1968 and 1970 autumn counts on the "West Side" of Liverpool Street station indicates a drop of 4½ m. passengers p.a. only. As a matter of "historic" interest a forecast made in 1955 predicted a drop of 6½ m. passengers p.a. On the sections of these lines immediately north of their interchange stations with the Victoria Line, where the diversion effect of the latter is

counteracted by its traffic-inducing effect, the pre-1969 predictions originally assumed slight net increases of traffic; by early 1969, however, mainly because of changes in bus traffic volumes and service patterns, the modified forecasts predicted a slight net loss of traffic. In the event, a predicted net loss at the rate of 0.1 m. passengers p.a. on the Eastern Region lines just north of Seven Sisters and Walthamstow Central turned out to be 0.2 m. according to the 1969 survey and 0.5/0.6 m. according to the 1970 survey whilst, as already mentioned in paragraph 67 the Bishop's Stortford Line north of Tottenham Hale still showed a net increase of 0.4 m. (1970), but this change could be due to Eastern Region timetable changes.

94. There are no records of earlier predictions of the effect of the Victoria Line on British Railways' traffics on the King's Cross and St. Pancras lines. In the case of Euston, an estimate made in early 1969, based on a questionnaire survey which the London Midland Region had carried out in 1967, predicted an increase in the number of L.M.R. passengers travelling via the Euston d.c. routes rather than the Bakerloo Line by 213,000 passengers p.a. which compares with an increase of roundly 524,000 according to the 1970 survey.

95. One of the conclusions which might be drawn from the fact that most of the predictions for traffic diversions to the Victoria Line from British Railways turned out to be on the low side, may well be that the traffic assignment formula successfully applied to traffic diversions within the Underground network requires further modification if applied to diversions from British Railways, crediting the high-frequency services of the Underground type with a somewhat higher relative attraction than that already taken into account in the waiting times. Another contributory factor may be that, because of the greater complexity of the main line networks, the difference between scheduled and average actual journey times may be greater, and their predictability lower with them than with the Underground, so that passengers show a somewhat greater tendency to prefer the latter.

### 5.6. Forecasts of "diverted" and "generated" traffic

96. In contrast to the geographical spread of the effects of the Victoria Line, comparisons between predicted and actual traffics by categories are difficult. This is because the forecasts were based on separate estimates, in terms of passengers and passenger mileage, of "generated" traffic and of traffic diverted, respectively, from other Underground lines, from British Railways, from buses and from private transport whilst, as explained in Chapter 3.13, the evaluations of the survey results had to be classified under the headings "Diverted from rail and mixed modes", "Diverted from bus only", "Diverted from car only", "Generated" and "Residual". The following comparisons between the 1958 and 1969 forecasts on the one hand and the May/June 1969 and May/June 1970 surveys on the other hand, must therefore, be regarded with considerable reserve.

97. In the 1958 and 1969 forecasts, the total percentage share of "traffic new to public transport", i.e. traffic generated by the new facility plus traffic diverted from private transport, was in terms of Victoria Line passenger *mileage* estimated to be 30 and 31 per cent., respectively. According to the May/June 1969 survey (cf. paragraph 52), the total percentage share of passenger *journeys* "generated" and "diverted from car only" amounted to 9 per cent. at that time, rising to 22 per cent. in May/June 1970. But, apart from any inaccuracies due to comparing passenger mileage with passenger journeys, the category of traffic "diverted from car only" cannot be directly compared with the earlier estimates. Even so, it is possible that there had been some over-estimation, perhaps not so much of the total "generated" and "ex-motorist" traffic, but rather of the rate at which the traffic would accrue to the line after the opening.

98. Similar cautions apply to a comparison between forecast and actual Victoria Line traffic diverted from the buses. In terms of passenger mileage percentages, the 1958 forecasts anticipated an ex-bus element of 19 per cent. which, because of the general decline in bus traffics was reduced to 13 per cent. in the early 1969 forecasts. On the other hand, the actual percentage of passenger *journeys* "diverted from buses *only*" came to 9 per cent. in May/June 1969, falling slightly to 8½ per cent. in May/June 1970 (see paragraph 52).

99. No similar comparison can be made for traffic diverted from British Railways since, in the two surveys, the journeys diverted from British Railways were merged in the general category of traffic "diverted from rail and mixed modes". For traffic diverted from other Underground lines and from British Railways taken together, the 1958 forecast assumed a passenger *mileage* percentage of 52 per cent. rising to 56 per cent. in the early 1969 forecast, whilst the actual passenger journey percentages for traffic "diverted from rail and mixed modes" amounted to 82 per cent. in May 1969 and to 69½ per cent. in May 1970 (cf. paragraph 52). Whilst, as already pointed out, such a comparison must be regarded with considerable reserve it is at least compatible with a possible underestimation of traffic diverted from British Railways, already discussed in Chapter 5.5.

## 6. G.L.C. HOUSEHOLD SURVEY

### 6.1. Purpose and method of the household survey

100. In order to test the impact of the Victoria Line on the areas directly or indirectly served by it in the northern suburbs, the Greater London Council conducted a series of "before-and-after" household interview surveys. The surveys were carried out by Research Projects Ltd. in August 1968, just before the first section of the Victoria Line was opened from Walthamstow Central to Highbury & Islington in September 1968, and again in August 1969, five months after the line was opened all the way to Victoria. They were in the form of a "cluster" survey covering 58 census enumeration districts, partly selected at random in the direct catchment area of the Victoria Line (e.g. in the Walthamstow and Tottenham areas) and partly selected judiciously in areas with convenient rail or bus connections to the Victoria Line (e.g. in the Enfield, Southgate and Hornsey areas).

101. The "before" interviews covered 5,233 households with about 13,800 persons (an average of 2.64 persons per household). Of these, 4,621 households (88 per cent.) with about 12,200 persons were successfully reinterviewed in the "after" survey, including a proportion of households occupying the same dwellings but with new occupants. On this occasion 64.7 per cent. of the employed people were in the same job as in the "before" survey, 25.3 per cent. had changed their occupation or workplace during the year, and 10.0 per cent. were employed people new to the area. This high turnover rate seems to support the findings and assumptions discussed in chapter 3.13.

102. The initial number of households (5,233), corresponding to an average of 90 households per census enumeration district, was meant to represent a sample of about 40 per cent. of all households in these districts so that the aggregate figures would be representative of about 13,000 households with about 34,000 persons. But in some of the tabulations the results were further grossed up to represent 1,000 households per sampling cluster, which would correspond to a total of 58,000 households with some 150,000 persons. But the different scaling factors were used only for the standardisation of the presentation of results, and were not meant to have any other significance.

103. The interview forms used for each survey were similar in concept. They included questions on household information (number of persons; employment; car ownership), personal details (type of occupation; income group; address of workplace; main mode of travel; use of a car), and details of home-based work trips and non-work trips, the latter being sub-divided into eight further categories (employer's business; personal business; entertainment; sport; social; shopping; accompanying someone else; school).
The main difference between the forms used in the "before" and "after" surveys, respectively, was that the "after" survey form included questions as to who was present and available to make trips on the interview day; this was in order to mitigate the "August effect" on trip rates, with part of the household being on holiday. The "after" survey form also included questions relating to the frequency of use of the Victoria Line and was accompanied by the personal details page from the "before" survey form to enable the interviewer to match the people between the two interviews.

104. Before the results of these surveys can be discussed, it is important to realize their limitations. These arise from the timing of the surveys, from the limitations inherent in the "cluster" method of sampling, and from the smallness of the percentage of the total number of Victoria Line trips on which the results may be said to have a bearing.

105. As far as the time is concerned, the "after" survey in August 1969 took place 11 months after the line was opened to Highbury & Islington (making contact with the Piccadilly and Northern City lines), but only five months after the line was opened to Victoria (7th March, 1969) and within less than three months after the May/June 1969 survey on the Victoria Line itself. Yet in the twelve months from May/June 1969, the traffic on the Victoria Line increased by 40 per cent. The household survey in August 1969 therefore took place during the first quarter of a 12-month period when Victoria Line traffic was still rising at a considerable rate. The household survey must, therefore, be expected to understate the impact of the Victoria Line. The further fact that the household survey had to be carried out during the height of the holiday season has already been referred to.

106. As regards the limitations inherent in the "cluster" method of sampling, these arise partly from the randomness of the cluster selection and partly from the random mixture of clusters inside and outside the direct catchment area since the impact of the Victoria Line on the latter must of course be expected to be more marginal than on the areas directly served. Thus, whilst this cluster sampling method ensured an adequate number of interviews with similar geographical parameters, it cannot be regarded – and was not meant to be regarded – as representative for the suburban catchment area as a whole, and the total grossed-up number of residents – some 150,000 – does not represent the population of any coherent or readily identifiable catchment area.

107. Finally, it is important to realize that any conclusions drawn from the results of the household surveys could only be applied to a small percentage of all the Victoria Line trips. Thus, the "after" survey yielded a (grossed-up) total of 11,650 one-way home-based Victoria Line trips per day – a figure which, to cover non-homebased trips, might be rounded up to (say) 13,000 one-way trips per day. This figure represents no more than 7 per cent. of the 186,000 daily Victoria Line trips in May/June 1969, and no more than 5 per cent. of the 260,900 in May/June 1970.
In this connection, it is also relevant to recall (from paragraph 25) that the four Victoria Line stations north of Finsbury Park jointly account for about 10 per cent. of all Victoria Line trip ends.

108. Despite all these important reservations, the results of the household survey can still give an indication of the initial impact of a new rapid transit facility on an already developed suburban area. The main results are discussed in the following chapter 6.2 whilst chapter 6.3 is devoted to a closer analysis of the work trips and chapter 6.4 to the Victoria Line trips covered by the household survey.

## 6.2. Main results of the household survey

109. *Appendix P* shows, for August 1968 and August 1969, the daily numbers of basic home-based trips, in toto for each main mode, made by approximately 150,000 persons resident in the northern and north-eastern suburbs for whom the cluster survey might be regarded as representative. *App. P.*
In the absence of a clear definition of the population or area concerned, it is the percentage increases and decreases which must be regarded as relatively more significant than the basic figures.

110. The total daily number of trips for all purposes was found to have increased, over the year, from 206,550 to 217,200 i.e. by 5.2 per cent. If one ignores main-mode walk trips which are liable to be affected by differences in interpretation by the interviewers and can in any case hardly be influenced by the advent of the Victoria Line, the total number of "non-walk" trips shows an increase from 159,790 to 164,050, i.e. by 2.7 per cent., corresponding to an increase from 1.06 to 1.09 trips per person or (with an average of 2.64 persons per household) from 2.81 to 2.89 trips per household.

111. Within the total number of "non-walk" trips, the changes for each main mode were influenced by three different developments. Apart from the advent of the Victoria Line, there was a general decline in bus traffic accompanied by a corresponding increase in trips by private transport, mainly over short distances, which has nothing to do with the Victoria Line. Finally, the numbers of trips using the buses as the main mode were also affected by some important changes in the bus route network, especially in the Walthamstow area, with a shift of emphasis from "long" bus routes to "short" routes acting as feeders to the railways. As a combined result of these three developments, the number of trips using the buses as the main mode declined, over the year, by 11.3 per cent. and the share of the buses in the total number of non-walk, main mode trips was reduced from 28 to 24 per cent.

112. In contrast to the buses, there has been – as expected

– a very significant increase of 36.7 per cent. in the number of trips made by Underground as the main mode. As this figure represents a *net* increase over and above those passengers who have seen their advantage in transferring their patronage from the pre-existing Underground lines, (mainly the Piccadilly and Central Lines), the increase of 36.7 per cent. in fact understates the impact of the Victoria Line on the suburban area served by it. Similar considerations apply to the ex-British Rail passengers who have seen their advantage in transferring their main mode of travel to the Victoria Line (reflected in the 13.5 per cent. loss in B.R. traffic) so that the net overall increase in rail traffic (9.4. per cent.) likewise understates the impact of the Victoria Line.

113. The percentage increase in the number of trips using the railways as the main mode becomes even more significant if the "captive" journeys to and from work are excluded and the comparisons are confined to the more "optional" trips for other purposes. As Appendix P shows, the total number of "trips for other purposes" amounted, in August 1969, to 88,530 out of 217,200, i.e. to 41 per cent. of all trips (leaving a balance of 59 per cent. for trips to and from work), or to 57,280 out of 164,050, i.e. 35 per cent. of all non-walk trips (leaving a balance of 65 per cent. for trips to and from work). For these trips other than work trips, there was an increase over the year of 14.9 per cent. or, if walk trips are excluded, of 11.5 per cent. The Underground alone showed an increase over the year of 93.2 per cent., i.e. it nearly doubled its traffic, while even British Rail showed a net increase of 16.9 per cent. and rail traffic as a whole a net increase of 52.9 per cent.

114. Some interest also attaches to a closer analysis of the 6,210 net *additional* Underground "main-mode" trips by journey purpose. If allowance is made for a small decrease of 60 trips in the categories of "accompanying someone else" and "school" traffic, the resulting gross increase of 6,270 Underground trips is composed as follows:

| | |
|---|---|
| On personal business | 8 per cent. |
| Entertainment and sport | 14 per cent. |
| Social | 9 per cent. |
| Shopping | 7 per cent. |
| All purposes other than work | 38 per cent. |
| Trips to and from work | 62 per cent. |

It is worth noting that the non-work percentage of additional Underground journeys (38 per cent.) is significantly higher than the non-work percentage of 29 per cent. ascertained from the May/June 1970 survey on the whole of the Victoria Line itself (cf. paragraph 45).

115. As far as the in-town distribution of the journeys from and to the household survey "clusters" is concerned, the "after" survey in August 1969 came too soon after the opening of the Victoria Line (as far as Victoria) to indicate any major changes in the general origin-and-destination pattern of home-based journeys. If all the "clusters" are taken together, i.e. including those not directly served by the Victoria Line, roughly one-quarter of all home-based (non-walk) trips were to and from the central area, and these trips were split 50/50 between the City and the West End (including Victoria and Kensington) in both years. If one takes a group of clusters more directly served by the Victoria Line, e.g. the Tottenham group where the total number of home-based non-walk trips increased by 8 per cent. over the year, the Central London share in all these trips increased by 10 per cent. and the West End share (including Victoria and Kensington) by 27 per cent., indicating a much stronger impact of the Victoria Line.

### 6.3 "Before-and-after" analysis of work trips covered by the household survey

116. A special analysis has been carried out of the "before-and-after" pattern by main mode of travel for work trips which, in August 1969, amounted to 59 per cent. of all trips (cf. paragraph 113). As the Victoria Line had a relatively greater impact on non-work traffic than on work trips (as likewise set out in paragraph 113), the results of this analysis, summarized in percentage terms in *Appendix Q* once more understate the effect of the Victoria Line. *App. Q.*

117. As the table shows, the share of the Underground in the total number of trips to or from work rose from 11.1 per cent. in the "before" survey to 15.2 per cent. in the "after" survey, composed of 7 per cent. on the Victoria Line and 8.2 per cent. on other Underground lines. The precise origin of the Victoria Line work trips by previous main mode was as follows:

| | |
|---|---|
| Car drivers | 6.4 |
| Car passengers | 3.0 |
| Motor cycle | 1.5 |
| Sub-total, private motor transport | 10.9 |
| Walk or cycle | 1.2 |
| Bus | 23.6 |
| British Rail | 34.7 |
| Underground | 29.6 |
| | 100.0 |

The ex-motorist share of 10.9 per cent. is of course considerably greater than the (reasonably comparable) share of ex-motorists in the total number of Victoria Line passengers (e.g. 5,500 out of 209,400 "diverted" trips – i.e. 2.6 per cent. – based on the May/June 1970 survey, see paragraph 52), indicating the relatively greater attraction of the new rapid transit facility on longer-distance motoring.

118. British Rail's share fell from 15.2 to 12.9 per cent. i.e. by 2.3 per cent. of the total number of work trips, a net loss exactly corresponding to the net transfer from British Rail to the Underground as the gains and losses from and to all other modes cancel out. The share of the buses fell from 19.4 to 17.2 per cent., i.e. by 2.2 per cent. of the total number of work trips; this loss is made up of a net loss of 1.3 per cent. to the Underground, a net loss of 0.2 per cent. to British Rail, a net loss of 0.7 per cent. to private motor traffic, and a slight net gain from "walk, cycle and other".

### 6.4. Characteristics of Victoria Line trips covered by the household survey

119. As already mentioned in paragraph 107, the household survey in August 1969 yielded a (grossed-up) total of 11,650 one-way home-based Victoria Line trips per day, a figure representing about 7 per cent. of all the non-walk trips assumed to be covered by the household survey (164,050), but less than 5 per cent. of all the trips ascertained from the May/June 1970 Victoria Line survey

(260,900). Despite this low incidence of the household survey trips on the Victoria Line traffic as a whole, and despite the other limitations inherent in the cluster method and in the relatively early date of the "after" survey, already discussed in chapter 6.1, certain characteristics relating to the Victoria Line trips from and to the northern suburbs will still be of interest.

120. Not suprisingly, nearly all (98 per cent.) of the 11,650 trips originated or ended at Victoria Line stations north of King's Cross, whilst 82 per cent. ended or originated in the central area. The mean distance travelled on the Victoria Line was 5.5 miles which is significantly – almost twice as long as the mean distance travelled by all the Victoria Line users (2.8 miles, see chapter 3.3).

121. Classified by trip purpose, about 70 per cent. of the 11,650 Victoria Line trips were journeys to or from work, and about 30 per cent. trips made for other purposes. Classified by types of persons, about 80 per cent. of the trips were made by "employed persons", about 10 per cent. by "students" and about 10 per cent. by "non-employed persons". Classified by change in status between August 1968 and August 1969, about one-half of these trips were made by persons in the same occupation, about one-third by persons who had changed their occupation or work place during the year, about one-sixth by persons new to the area, either in pre-existing households or in completely new households.

122. Of the work trips, representing about 70 per cent. of all the Victoria Line trips covered by the household survey, just under two-thirds were "matched" trips in the sense that they were made by the same person to the same place at approximately the same time of day for the same or similar purpose both in 1968 and in 1969, whilst just over one-third were "modified" trips in the sense that, though satisfying the "matching" conditions, they were made to a different destination – mainly a change of job, presumably prompted by the new facility. It may also be interesting to note that the mean journey time saving per "matched" work trips on the Victoria Line was 6.9 minutes whilst the persons using the Victoria Line for "modified" work trips have, on average, seen their advantage in even accepting a slight time loss of 0.5 minutes to seek a better or more convenient job made more easily accessible by the Victoria Line.

## 7. EFFECT OF THE VICTORIA LINE ON PROPERTY VALUES AND LAND USE

### 7.1. Effect of the Victoria Line on existing property values

123. One important aspect of the creation of a new "rapid transit" facility is the effect which it has on existing land values and, in the longer term, on changes in land use. As regards the effect on existing property values, there is the often quoted example of the Yonge Street Subway in Toronto where the increase in rateable values in the "catchment area" of the line was reported to have been so great that the entire cost of construction and operation was more than covered by the increase in rates revenue. It should be appreciated, however, that the effect on property and land values does not in itself represent "social benefit" and can at best be regarded as an indirect measure for the latter.

124. In the case of a new Underground railway which, like the Victoria Line, passes through a central business district already served by a number of similar lines, the effect of the new line on downtown property values can hardly be dramatic, and is likely to be confined to individual developments. In contrast, a more significant effect on property values can be expected in the suburbs where the new line represents a more drastic improvement to the travel facilities to and from the central area.

125. In an attempt to assess this effect, London Transport's Estate Department has carried out a special survey of the effect of the Victoria Line on property values in the vicinity of the six outer stations of the line, i.e. from Highbury to Walthamstow Central, inclusive. The survey was carried out as follows

126. First, the geographical spread of the joint "catchment area" of the six stations was established from data available from the May 1969 survey, and was equated with "London Traffic Survey" zones for which specific data such as population, number of households and commercial floor space were available from the 1966 population census. This was followed by valuations of average pre-Victoria Line house prices in each zone and by an overall valuation of commercial floor space. Finally, an estimate of the percentage increase, due to the Victoria Line, in the property values in the different zones was prepared with the assistance of local estate agents. In this estimate, the general inflationary trend in real estate value was, of course, taken into account.

127. It was found that the total increase in property values in the catchment area of the six suburban Victoria Line stations was of the order of £35 million made up of £33 million due to the appreciation of residential property and £2 million due to the appreciation of commercial property, i.e. shops and offices. This amount very nearly equates with the total cost of this section of the line (excepting the rolling stock depot at Northumberland Park and its approach line).

128. The pecentage increase in property values was found to vary considerably within the total catchment area, being confined to about 1 per cent. at Walthamstow where the average income per household is low and a higher proportion of residents continue to work locally (see also Chapter 6), but rising to 5 per cent. at Highbury & Islington where residents are, on average, more affluent and include a higher percentage of central area commuters.

### 7.2. Long-term effect of the Victoria Line on land use and activity patterns

129. In the short term, the activity patterns, e.g. fixed employment and residences, in the vicinity of a new rapid transit facility such as the Victoria Line might reasonably be regarded as fairly static although, as already discussed in connection with "generated" traffic, some of the latter could be ascribed to early changes in these patterns even after not much more than one year of operation. In the longer term, however, the change in these patterns must be expected to become much more pronounced. In other words, the Victoria Line is not only causing an increase in the value of existing properties in the area served by it but should also, albeit at a slower pace, have a direct or indirect effect on competing land uses such as offices, shops, industry, housing, all of which may be differently affected by the greatly improved access to the central area.

130. In view of the potential importance of such long-term changes in land use and activity patterns and the interest attached to them also for predictive purposes in connection with other public transport improvement schemes, the Operational Reseach Department of London Transport

has initiated a study of these changes in the northern suburban area served by the Victoria Line where the line has been open since September 1968. The first stage of this study has now been completed, and there is some evidence that since the opening of the line, the catchment area of the Victoria Line has attracted a greater proportion of the total office development in the G.L.C. area. It has however not yet been possible to formulate a relationship on a more detailed zonal basis. Such developments are, of course, subject to planning constraints.

## 8. SUMMARY AND CONCLUSIONS

### 8.1. Summary

131. The present report is exclusively concerned with the impact of the Victoria Line during the period from 7th March 1969 when passenger services were extended from the north as far as Victoria, and before the line was further extended to Brixton (23rd July 1971). An appreciation of the effect of the Brixton extension must await the evaluation of further surveys.

132. Apart from systematic "before-and-after" observations of train and bus loadings as well as road traffics, the assessment of the impact of the Victoria Line was mainly based on a pair of questionnaire surveys on the line, held in May/June 1969 and May/June 1970, and on a household survey carried out by the Greater London Council in the northern suburban area served by the line. Attempts were also made to study the impact of the line on property values and, in the longer term, on land use patterns.

133. From the surveys on the line, the Victoria Line was found to carry, in May/June 1969, a total passenger mileage at the rate of 165 million per annum and, in May/June 1970, a total passenger mileage at the rate of 229 million per annum. The forthcoming Great Northern electrification scheme will give rise to an influx of additional traffic via the interchange station at Highbury & Islington.

134. In terms of passenger journeys, the Victoria Line carried 186,000 passengers per day in May 1969 and 260,900 in May 1970, an increase of 40 per cent.
The corresponding annual rates were 58 and 81 million passengers, respectively. The average distance travelled on the Victoria Line was, in both years, 2.8 miles. Three-quarters of all "trip ends" were located at the six "in-town" stations and only one-quarter at the six "out-town" stations (north of King's Cross). Nearly one-half of all passengers used Victoria and/or Oxford Circus stations. The sectional "traffic densities" (number of passengers per annum, both directions together) varied, in May/June 1970, from a maximum of 41.6 million between Green Park and Oxford Circus to a minimum of 5.2 million between Blackhorse Road and Walthamstow Central.

135. As regards the mode of transport used before entering or after leaving the Victoria Line, connecting rail journeys accounted for 50 per cent. of all Victoria Line trip ends (29 per cent. Underground, 21 per cent. British Rail).
Of the Underground trip ends, nearly one-half were accounted for by the four Victoria Line stations with cross-platform interchange facilities (Oxford Circus, Euston, Highbury & Islington, Finsbury Park). Of the British Rail trip ends, over one-half were accounted for by Victoria station alone. Most of the bus and "park-and-ride" or "kiss-and-ride" trip ends were found to be at stations north of Highbury & Islington.

136. An analysis of the geographical spread of the Victoria Line trip ends shows that the benefits obtained from the line are shared by large areas of Greater London; in fact, nearly 60 per cent. of all Victoria Line journeys to or from the West End are from or to areas not directly served by the Victoria Line.

137. According to the May/June 1970 survey, one-way peak-hour traffic flows on the critical sections of the line (between Euston and Warren Street, and between Victoria and Green Park) were of the order of 16/17,000, representing about one-quarter of the one-way all-day traffic over the sections concerned. Occasional loading observations have yielded higher figures.

138. An estimate, of necessity based on somewhat arbitrary assumptions, indicates that about 20 per cent. of the passengers using the Victoria Line in May/June 1970 could be classified as "generated" traffic whilst nearly 70 per cent. were "diverted from rail and mixed modes", some 8 per cent. from "buses only" and 2 per cent. from "cars only".

139. A closer "before-and-after" analysis, based on the May/June 1970 survey, of the different categories of "diverted" traffics, shows, e.g. that the Victoria Line has eliminated 5,500 "car only" person trips corresponding to about 4,000 long-distance vehicle trips per day but has, on the other hand, induced about 5,000 additional short-distance "park-and-ride" (or "kiss-and-ride") person trips per day. The net reduction in bus passenger trips was 34,200 per day.

140. The Victoria Line has brought drastic relief to certain sections of other Underground lines, notably on the District Line between Victoria and Charing Cross, on the Piccadilly Line between Finsbury Park and Green Park and on the Northern Line between Euston and Charing Cross.
Less drastic but highly welcome relief has been afforded to the Northern Line "bottleneck" sections between Morning-ton Crescent and Euston (due to the cross-platform interchange facility between the Victoria Line and the City branch of the Northern Line at Euston, causing a shift of traffic from the Charing Cross trains to the less heavily used City trains), between Waterloo and Charing Cross, and again between London Bridge and Bank (due to the diversion of Southern Region traffic via Victoria), and also to the Central Line between Leyton and Oxford Circus.

141. On the other hand, the Victoria Line has – as expected – induced some additional traffic on the Bakerloo Line north of Oxford Circus and on the Central Line west of Oxford Circus.

142. The Victoria Line has had considerable effects on British Railways' traffics, especially on the suburban lines into Liverpool Street (where a sizeable proportion of the traffic from and to the Chingford and Enfield Lines has been diverted to the Victoria Line) and into Victoria where the Victoria Line has attracted considerable volumes of new traffic and traffic diverted from other Southern Region terminals.

143. Comparisons between the May/June 1969 and May/June 1970 survey results on the one hand and the previous traffic estimates on the other hand have, by and large, confirmed the validity of the methods of estimation in forecasting the broad pattern of traffic attraction of the new line. Notable exceptions were the effect of the Victoria Line on the Highbury Branch of the Northern Line, which

was greatly over-estimated, and on the Southern Region traffics at Victoria, which was greatly under-estimated. The actual level of traffic throughout the "in-town" section of the Victoria Line south of Finsbury Park was, by summer, 1970, well above the estimate made in 1969.

144. The results of the "before-and-after" household surveys carried out by the G.L.C. in the northern suburbs directly or indirectly served by the Victoria Line are subject to certain qualifications, arising from the "cluster" method of sampling, from the timing of the surveys, from the limited incidence of the survey on the total number of Victoria Line journeys (approximately 5 per cent.), and from the fact that the advent of the Victoria Line coincided with a reshaping of bus services and a general trend from buses to private cars. Subject to these qualifications (all of which tend to underestimate the impact of the Victoria Line), the results indicate a comparatively small increase in the total number of "main mode" trips (5.2. per cent.), a marked decline in the number of trips using the buses as the main mode and a major percentage increase (36.7 per cent.) in the number of trips using the Underground as the main mode – a percentage rising to 93.2 per cent. if applied to the "non-work" journeys alone which, in contrast to the "captive" journeys to and from work, are more responsive to the quality of services offered.

145. Of all the work trips covered by the household surveys, representing 59 per cent. of all trips, the share of the Underground rose from 11.1 per cent. in the "before" survey to 15.2 per cent. in the "after" survey. Of the Victoria Line work trips, about 11 per cent. were transfers from private motor transport, about 24 per cent. from the buses, about 35 per cent. from British Rail, and 30 per cent. from other Underground lines.

146. Of all the trips on the Victoria Line covered by the household surveys, composed of work trips (70 per cent.) and non-work trips (30 per cent.), 82 per cent. ended or originated in Central London. The average distance travelled on the Victoria Line by all the Victoria Line passengers covered by the household surveys was 5.5 miles, nearly twice as long as the mean distance travelled by all Victoria Line passengers. Those passengers using the Victoria Line for journeys to work at the same workplace as before had an average time saving of 6.9 minutes per trip.

147. An initial study conducted by London Transport's Estate Department indicated that the increase in property values in the suburban catchment area of the Victoria Line, allowing for inflation, might be of the same order of magnitude as the construction cost of the suburban section of the line. The first stage of a study, conducted by London Transport's Operational Research Department, of the long-term effects of the Victoria Line on land use and activity patterns has been completed, and work is continuing in this field; the results so far would appear to indicate that, compared with the rest of London, more office building has occurred in the vicinity of the Victoria Line since it opened though it has not yet been possible to validate this, as an effect due to the Victoria Line, at the zonal level. Besides, this rate of development is governed by planning constraints.

## 8.2. Conclusions

148. Even in a town which, like London, has had a fairly closely meshed network of urban railways for a long time, the opening of a new cross-town line – the first for about sixty years – is obviously a major event which is bound to have an important effect on the London scene. A scheme of this magnitude calls for very large capital investments which are, to some extent, in danger of being wastefully employed if the planning concept is faulty. That is why a quantified account of the success of such a scheme should be of interest not only to Londoners but also to transport and planning authorities in many cities throughout the world.

149. For, a success it has undoubtedly been. Anyone doubting this statement should have a look at the Victoria Line trains at Victoria or Oxford Circus during the peak periods – he will wonder how London ever managed without this line!

150. The success has, of course, not been uniform throughout the line. Traffic on the outer section has only just come up to expectations, and the short-term impact of the line on the northern suburbs has not been dramatic. There may be a more profound impact in the longer term, through an increasing awareness on the part of the local planning authorities of the opportunities afforded by the new urban railway facility. Similarly, the diversion of traffic from private to public transport has proceeded at a slower rate than was expected although the elimination of about 5,500 "car only" journeys, representing (approximately) 4,000 vehicle trips a day makes a useful contribution towards the relief of road congestion.

151. In other respects,the Victoria Line has exceeded expectations. Traffic on the central area section of the line is much heavier than forecast. The relief effect on other Underground lines and on British Railways has also been greater than expected. At the same time, the line has generated a significant amount of "new" traffic which, though difficult to quantify, appears to be up to 20 per cent. of the total traffic on the line.

152. One of the most significant facts emerging from the survey is the wide geographical spread of the benefits obtained from the Victoria Line, largely due to the multiple interchange facilities with other lines. In fact, no less than 60 per cent. of all Victoria Line passengers live or work in areas not directly served by the line.

153. The last in a series of estimates of Victoria Line traffic was made in 1969, just before the line opened to Victoria. The traffic reached this forecast, measured in total passenger miles travelled on the Victoria Line, within about four months of the opening to Victoria, and in fifteen months had risen to a level about 35 per cent. above the estimates made in 1969.

154. It would be wrong to conclude that the traffic estimates for the Fleet Line, which have been made on a generally similar basis to the 1969 Victoria Line estimates, are likely to be exceeded to the same extent of 35 per cent. by actual Fleet Line traffics within fifteen months of opening. This is because, following a review of the processes of forecasting used for the Victoria and Fleet Lines respectively, it is now apparent that in the latter case a somewhat fuller analysis was made of all possible sources of traffic.
The Fleet Line estimates are likely, therefore, to be closer to the actual traffics which will eventually be carried, but this does not mean that the Fleet Line will be less successful in attracting passengers than the Victoria Line. It seems clear that the Victoria Line has had a special power to attract traffic in the inner area, above expectations, because

of its image as a modern, fast, reliable and efficient transport facility. The Fleet Line, coming not many years after the Victoria Line, can perhaps not be expected to have quite the same effect; but it will have similar characteristics and should make a major impact on travel through the areas of inner London which it will serve.

155. Thus the actual Victoria Line results, when compared with the traffic estimates prepared in 1969, suggest that present methods of traffic prediction, as currently used by London Transport for Underground developments including the Fleet Line, are well on the conservative side in relation to traffic levels likely to be experienced about fifteen months after the opening of the new facility.

156. Meanwhile, the opening of the extension of the Victoria Line to Brixton on 23rd July, 1971 has created a new situation, calling for a re-appraisal of the line as a whole. This will have to await the results of a major "origin-and-destination survey" for which the fieldwork was completed in May 1972 and which is being supplemented by more specific surveys of traffic in the areas served by the Brixton extension.

## APPENDIX A
## VICTORIA LINE TRAFFIC STUDY
## VICTORIA LINE PASSENGER SURVEY – MAY/JUNE 1969
## SURVEY METHOD AND ANALYSIS

### THE SURVEY

1. The questionnaire card reproduced here was distributed to a sample of passengers entering the Victoria Line from the street and by interchange from other lines. This required the manning of 65 distribution points, i.e. all points at which passengers actually enter the Victoria Line (ranging, for example, from the one entry by escalator at Blackhorse Road station to the numerous points of access to the Victoria Line platforms at Oxford Circus station).

2. Between 5th and 21st May, 1969, a count of total passenger flow at each point by quarter hour time periods between 07.00 and 22.00 hours was taken to ascertain the numbers of cards to be distributed in each period and also for use in the analysis for weighting the replies received. The same points were manned on a second occasion (5th to 18th June, 1969) for distribution of a predetermined sample of questionaires in each of the time periods, i.e. to 1 in 4 passengers in the morning peak, to 1 in 3 passengers in the evening peak and to 2 in 5 passengers in the off-peak. Except where flow rates were very low, it was impracticable to hand a questionnaire to precisely every *n*th person passing a point; the only control, therefore, was on the total numbers distributed within fairly short time periods.

3. The numbers of passengers counted and the numbers of questionnaires distributed and returned were as follows:

### THE ANALYSIS

4. In the first instance, a factor was calculated for each time period within each station, by relating the initial count to the number of usable questionnaires returned . All the subsequent analysis was carried out in terms of weighted figures, i.e. each questionnaire was treated as representing a number of people equal to the above factor.

5. Four types of data were distinguished:–

   (a) "After" journeys, as detailed in the answers to question 6 (see attached questionnaire).

   (b) "After" journeys previously made by some other route or mode of transport, i.e. diverted traffic. The probability of respondents being included in the survey was obviously proportional to the frequency with which journeys on the Victoria Line were made. Similarly, the probability of having been included in a "before" survey, if such a survey had been undertaken, would have been proportional to the frequency with which the corresponding journey was made before the Victoria Line was opened. Thus, the total volume of diverted traffic was adjusted by multiplying by the ratio of "before" frequency (question 8) to "after" frequency (question 5). Diverted traffic was subdivided as follows

| | Number of passengers entering Victoria Line platforms | Number of questionnaires distributed | Number of usable questionnaires returned | Response rate | |
|---|---|---|---|---|---|
| | | | | Per cent. of initial count | Per cent. of questionnaires distributed |
| Walthamstow Central | 5,739 | 1,781 | 615 | 11 | 35 |
| Blackhorse Road | 3,186 | 1,022 | 290 | 9 | 28 |
| Tottenham Hale | 2,414 | 743 | 234 | 10 | 31 |
| Seven Sisters | 7,089 | 2,230 | 532 | 8 | 24 |
| Finsbury Park | 20,292 | 6,066 | 1,638 | 8 | 27 |
| Highbury & Islington | 7,983 | 2,780 | 780 | 10 | 28 |
| King's Cross | 15,900 | 5,377 | 1,373 | 9 | 26 |
| Euston | 14,861 | 4,880 | 1,489 | 10 | 30 |
| Warren Street | 8,867 | 3,259 | 1,023 | 12 | 31 |
| Oxford Circus | 35,791 | 12,643 | 3,666 | 10 | 29 |
| Green Park | 16,713 | 6,239 | 1,647 | 10 | 26 |
| Victoria | 38,406 | 12,819 | 3,573 | 9 | 28 |
| All Stations | | | | | |
| 07.00 to 10.00 hours | 58,789 | 14,660 | 5,243 | 9 | 36 |
| 10.00 to 16.30 hours | 47,490 | 18,920 | 4,219 | 9 | 22 |
| 16.30 to 19.00 hours | 57,211 | 20,716 | 6,167 | 11 | 30 |
| 19.00 to 22.00 hours | 13,742 | 5,543 | 1,231 | 9 | 22 |
| Total 07.00 to 22.00 hours | 177,241 | 59,839 | 16,860 | 10 | 28 |

(i) from car, i.e. respondents who travelled the *whole* of the "before" journey by car.

(ii) from bus, i.e. respondents who travelled the *whole* of the "before" journey by bus.

(iii) from rail and mixed modes, i.e. all other respondents who travelled between the same places for the same purpose before the Victoria Line was opened.

(c) The "before" journeys of diverted traffic, e.g. the rail route used before the Victoria Line was opened. For the reasons given above, these data were also adjusted by multiplying by the ratio of "before" frequency to "after" frequency.

(d) Generated traffic. Two types of generated traffic may be distinguished, i.e.

(i) an increase in the frequency of journeys which were made previously, e.g. if the number of journeys of a particular type increased from x to y, then x journeys may be classified as diverted and (y – x) journeys as generated; thus, this element of generated traffic may be estimated by multiplying the "after" journeys of all respondents who also made "before" journeys by (1 – the ratio of "before" frequency to "after" frequency),

(ii) completely new journeys, i.e. by respondents who never travelled between the same places for the same purpose before the Victoria Line was opened; some of these, however, did not make "before" journeys because they lived or worked elsewhere or for some other personal reason, and need to be excluded from the estimate of generated traffic; an attempt was made in question 11 to identify such people.

6. The above concepts may be illustrated by a simplified hypothetical example. If for 100 "after" journeys, all with frequency 5 per week, the following were the reported "before" journeys:–

10 by car at frequency of 5 per week
5 by car at frequency of 4 per week
40 by rail at frequency of 5 per week
20 by rail at frequency of 4 per week
15 were never made "before" – answer to question 11 was (a)
10 were never made "before" – answer to question 11 was (b).

then:–

Traffic diverted from car = (10 x 5/5) + (5 x 4/5) = 14
traffic diverted from rail = (40 x 5/5) + (20 x 4/5) = 56
generated traffic = (5 x 1/5) + (20 x 1/5) + 15 = 20

The total traffic accounted for in this way (90 journeys) differs from the total of 100 "after" journeys by an amount equal to the number of respondents who never made the corresponding "before" journey because they lived elsewhere or for some other personal reason unrelated to the existence of the Victoria Line.

7. All of these figures are, of course, necessarily based on data obtained from the passengers who used the Victoria Line at the time of the survey. In as much as these passengers have, as a result of the Victoria Line, ceased to use (or are newly using) sections of existing railways, the resulting change in traffic density on those sections cannot be regarded as a true measure of the total effect of the Victoria Line on them. This is because the figures fail to take into account those passengers who used the pre-existing sections of the lines prior to the Victoria Line and would subsequently have used the latter but for a change in personal circumstances (e.g. because they have moved out or have died) so that they are not covered by the 1969 survey. As explained elsewhere in the Report, the attempt has been made to solve this problem by assuming that the number of such passengers was equal to the number of passengers who, in the 1969 survey, stated that because of a change in personal circumstances they would have been unable to use the Victoria Line before.

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LONDON, S.W.1

# Help to plan your underground service

The Victoria Line, which was built to improve the Underground service as a whole and to provide good interchange with other lines, has resulted in considerable alterations to travel patterns in London.

London Transport, in co-operation with the Ministry of Transport and the Greater London Council, are carrying out a survey to build up a comprehensive picture of these changes in order to find out whether the needs of the travelling public are being met and to help in planning future services.

Your travel needs will be taken into account if you will kindly complete this enquiry card and return to me the detachable reply paid portion, containing your answers. You can post the card (no stamp is needed) or put it in one of the special boxes provided at stations on the Victoria Line.

We would like details of the particular journey you were making when you received this card and also wish to know whether you used to travel between the same places by some other means before the Victoria Line was opened, and if so, how, and how often. Please complete this card, even if you have already completed a similar one for some previous journey on the Victoria Line.

All the information will be treated as strictly confidential. Thank you for your co-operation.

**F. Baker**
**PUBLIC RELATIONS OFFICER**
**LONDON TRANSPORT BOARD**

1 What type of ticket were you using for the journey you were making when you received this card? *Please tick.*
Season ☐ Other ☐ — 030258

2 What was the purpose of this journey? *Please tick once in the 'from' row and once in the 'to' row.*

| | Home | Work | School | Shopping | Entertainment | Other |
|---|---|---|---|---|---|---|
| FROM | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TO | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

3 From what address did you start this journey?
Number (or name), street and district

4 To what address were you travelling?
Number (or name), street and district

5 How often do you make this particular journey for the same purpose, counting journeys in this direction only? *Please tick one box only.*
Times a week ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ more than 6
Less often than once a week but more often than once a month ☐ Once a month or less often ☐

6 Please give details of all stages (excluding walking) of this journey. Indicate form of transport by ticking one of the first five columns for each stage, as in the following imaginary journey.

| by car | by bus | by British Rail | by Underground | by other means | | | Stage No. |
|---|---|---|---|---|---|---|---|
| | ✓ | | | | from Blanche Lane, Sth. Mimms | to Potters Bar Stn. | 1 |
| | | ✓ | | | from Potters Bar | to Finsbury Park | 2 |
| | | | ✓ | | from Finsbury Park | to Walthamstow Central | 3 |
| | | | | | from | to | 4 |

| by car | by bus | by British Rail | by Underground | by other means | | | Stage No. |
|---|---|---|---|---|---|---|---|
| | | | | | from | to | 1 |
| | | | | | from | to | 2 |
| | | | | | from | to | 3 |
| | | | | | from | to | 4 |

7 If the Underground or British Rail parts of your journey involved changing trains, *please say at which station (or stations) you changed.*

8 How often did you travel between the same places for the same purpose (by public or private transport) BEFORE any part of the Victoria Line was opened (i.e. BEFORE 1 SEPTEMBER 1968)? *Please tick one box only.*
NEVER ☐ (If 'NEVER' please answer question 11)
Times a week ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ more than 6
Less often than once a week but more often than once a month ☐ Once a month or less often ☐

9 If you travelled between the same places BEFORE any part of the Victoria Line was opened, how did you usually make the journey? *Please give details of all journey stages, excluding walking.*

| by car | by bus | by British Rail | by Underground | by other means | | | Stage No. |
|---|---|---|---|---|---|---|---|
| | | | | | from | to | 1 |
| | | | | | from | to | 2 |
| | | | | | from | to | 3 |
| | | | | | from | to | 4 |

10 If the Underground or British Rail parts of the journey described in your answer to question 9 involved changing trains, *please say at which station (or stations) you changed.*

11 If the answer to question 8 is 'NEVER' (i.e. if you never made this journey before 1 September 1968), was this because:—
(a) the Victoria Line did not exist, or
(b) for some other reason, e.g. you lived somewhere else, you were still at school, etc.
*Please tick either (a) or (b).*
(a) ☐
(b) ☐

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## APPENDIX B
## VICTORIA LINE TRAFFIC STUDY
## VICTORIA LINE PASSENGER SURVEY – MAY/JUNE 1970
## SURVEY METHOD AND ANALYSIS

### THE SURVEY

1. The questionnaire card reproduced here was similar to that used in 1969, but for minor modifications and the inclusion of a new Question 6:

   "If your answer to Question 5 is once a week or more often (i.e., the frequency with which the particular journey, for the same purpose, was made), when did you first start using the Victoria Line for this particular journey?"

2. The handing out of the questionnaires was preceded by a count, taken between 5th May and 18th May, 1970, of the total numbers of passengers at each point of access to the Victoria Line by quarter-hour periods. During the time from 16th June to 29th June, 1970, a pre-determined number of questionnaires were handed out at the same points at a rate of 1 in 7 passengers in the morning peak, 1 in 6 passengers in the evening peak, and 1 in 4 passengers in the off-peak, representing a smaller sample size than in 1969.

3. The numbers of passengers counted and the numbers of questionnaires distributed and returned were as follows:

### THE ANALYSIS

4. The analysis of the data was similar to the method used for the 1969 survey, using weighted figures representing a number of people equal to the weight associated with each individual card. The classifications were the same as those used in 1969 but, because of the longer period of time since the opening of the line and the consequently greater number of "after" passengers who, for personal reasons, could not have made a comparable "before" journey, the distinction between "diverted" and "generated" traffic has become even more blurred, so that these figures have to be treated with a good deal of reserve.

5. The tabulations prepared by S.I.A. Ltd. include,

   – total journeys, subdivided by categories, time of day, journey purpose, origin and destination, and date when the passenger first began to use the Victoria Line;

   – station-to-station origin/destination matrices for complete, all-day "after" journeys by Victoria Line users, by categories and time of day;

   – "traffic densities" on each section of line and of interchange flows at each station, by categories, directions, and time of day;

   – diverted journeys, classified by "before" and "after" modes of transport;

   – the geographical distribution of origin and destination addresses of passengers starting or ending the rail part of their journey at a Victoria Line station, subdivided by mode of transport to or from the station.

| | Number of passengers entering Victoria Line platforms | Number of questionnaires distributed | Number of usable questionnaires returned | Response rate | |
|---|---|---|---|---|---|
| | | | | Per cent. of initial count | Per cent. of questionnaires distributed |
| Walthamstow Central | 6,824 | 1,157 | 349 | 5 | 30 |
| Blackhorse Road | 3,654 | 660 | 162 | 4 | 25 |
| Tottenham Hale | 3,148 | 546 | 120 | 4 | 22 |
| Seven Sisters | 10,122 | 1,807 | 446 | 4 | 25 |
| Finsbury Park | 28,280 | 5,001 | 1,095 | 4 | 22 |
| Highbury & Islington | 10,055 | 1,865 | 405 | 4 | 22 |
| King's Cross | 20,595 | 3,999 | 677 | 3 | 17 |
| Euston | 21,223 | 4,146 | 994 | 5 | 24 |
| Warren Street | 10,780 | 2,137 | 545 | 5 | 26 |
| Oxford Circus | 53,657 | 11,028 | 2,703 | 5 | 25 |
| Green Park | 24,201 | 4,778 | 1,266 | 5 | 26 |
| Victoria | 56,800 | 10,609 | 3,228 | 6 | 30 |
| **All Stations** | | | | | |
| 07.00 to 10.00 hours | 84,679 | 12,418 | 4,136 | 5 | 33 |
| 10.00 to 16.30 hours | 65,673 | 16,762 | 3,162 | 5 | 19 |
| 16.30 to 19.00 hours | 80,742 | 13,805 | 3,767 | 5 | 27 |
| 19.00 to 22.00 hours | 18,263 | 4,748 | 925 | 5 | 19 |
| Total, 07.00 to 22.00 hours | 249,357 | 47,733 | 11,990 | 5 | 25 |

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PUBLIC RELATIONS OFFICER
LONDON TRANSPORT
55 BROADWAY
LONDON SW1

# 121

## Help to plan your Underground service

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Your travel needs will be taken into account if you will kindly complete this inquiry card and return to me the detachable reply paid portion, containing your answers. You can post the card (no stamp is needed) or put it in one of the special boxes provided at stations on the Victoria Line.

We would like details of the particular journey you were making when you received this card and also wish to know whether you used to travel between the same places by some other means before you started to use the Victoria Line, and if so, how, and how often. Please complete this card, even if you have already completed a similar one for some previous journey on the Victoria Line.

All the information will be treated as strictly confidential. Thank you for your co-operation.

**F. Baker**
**PUBLIC RELATIONS OFFICER**
**LONDON TRANSPORT BOARD**

50591

1 What type of ticket were you using for the journey you were making when you received this card? *Please tick.*
Season ☐ Other ☐

2 What was the purpose of this journey? *Please tick once in the 'from' row and once in the 'to' row.*

| | Home | Work | School | Shopping | Entertainment | Other |
|---|---|---|---|---|---|---|
| FROM | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TO | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

3 From what address did you start this journey?
Number (or name), street and district

4 To what address were you travelling?
Number (or name), street and district

5 How often do you make this particular journey for the same purpose, counting journeys in this direction only? *Please tick one box only*
Times a week ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ more than 6
Less often than once a week but more often than once a month ☐ Once a month or less often ☐

6 If your answer to Question 5 is once a week or more often, when did you first start using the Victoria Line for this particular journey? (The Victoria Line opened by stages between September 1968 and March 1969.) *Please tick one box only.*
Before April 1969 ☐ April to June 1969 ☐ July to Sept. 1969 ☐ Oct. to Dec. 1969 ☐ Jan. to March 1970 ☐ April to June 1970 ☐

7 Please give details of all stages (excluding walking) of this journey. Indicate form of transport by ticking one of the first five columns for each stage, as in the following imaginary journey.

| by car | by bus | by British Rail | by Underground | by other means | | | Stage No. |
|---|---|---|---|---|---|---|---|
| | ✓ | | | | from Manchu Lane, Sth. Mimms | to Potters Bar Stn. | 1 |
| | | ✓ | | | from Potters Bar | to Finchley Park | 2 |
| | | | ✓ | | from Finchley Park | to Wattlemeadow Central | 3 |
| | | | | | from | to | 4 |

| by car | by bus | by British Rail | by Underground | by other means | | | Stage No. |
|---|---|---|---|---|---|---|---|
| | | | | | from | to | 1 |
| | | | | | from | to | 2 |
| | | | | | from | to | 3 |
| | | | | | from | to | 4 |

8 If the Underground or British Rail parts of your journey involved changing trains, *please say at which station (or stations) you changed.*

9 BEFORE YOU STARTED TO USE THE VICTORIA LINE, how often did you travel between the same places for the same purpose (by public or private transport)?
NEVER ☐ (*if 'NEVER' please answer question 12*)
Times a week ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ more than 6
Less often than once a week but more often than once a month ☐ Once a month or less often ☐

10 If you travelled between the same places BEFORE YOU STARTED TO USE THE VICTORIA LINE, how did you usually make the journey?

| by car | by bus | by British Rail | by Underground | by other means | | | Stage No. |
|---|---|---|---|---|---|---|---|
| | | | | | from | to | 1 |
| | | | | | from | to | 2 |
| | | | | | from | to | 3 |
| | | | | | from | to | 4 |

11 If the Underground or British Rail parts of the journey described in your answer to Question 10 involved changing trains, *please say at which station (or stations) you changed.*

12 If the answer to Question 9 is 'NEVER' (i.e., you never made this journey before you started to use the Victoria Line), was this because:
(a) your present journey was prompted by the existence of the Victoria Line, or
(b) for some other reason, e.g., you lived somewhere else, you were still at school, etc.
*Please tick either (a) or (b).*
(a) ☐
(b) ☐

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## APPENDIX C
## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEYS MAY/JUNE 1969/1970

### NUMBERS OF PASSENGERS PER WEEKDAY ENTERING OR LEAVING VICTORIA LINE PLATFORMS AT EACH STATION

| Station | May/June 1969 | | May/June 1970 | | Increase 1970 over 1969 (per cent.) |
|---|---|---|---|---|---|
| | Numbers | per cent. | Numbers | per cent. | |
| Walthamstow Central | 14,000 | 3½ | 16,800 | 3 | 20 |
| Blackhorse Road | 6,500 | 2 | 7,300 | 1½ | 12 |
| Tottenham Hale | 5,000 | 1½ | 5,800 | 1 | 16 |
| Seven Sisters | 12,500 | 3½ | 20,600 | 4 | 65 |
| Finsbury Park | 40,500 | 11 | 53,000 | 10 | 31 |
| Highbury & Islington | 16,500 | 4½ | 22.400 | 4½ | 36 |
| Sub-total (out-town) | 95,000 | 26 | 125.900 | 24 | 32 |
| King's Cross | 32,500 | 8½ | 43,700 | 8½ | 34 |
| Euston | 29,000 | 8 | 41,800 | 8 | 44 |
| Warren Street | 19,000 | 5 | 24,600 | 5 | 30 |
| Oxford Circus | 76,000 | 20½ | 113,100 | 21½ | 49 |
| Green Park | 36,500 | 9½ | 49,500 | 9½ | 36 |
| Victoria | 84,000 | 22½ | 123,200 | 23½ | 47 |
| Sub-total (in-town) | 277,000 | 74 | 395,900 | 76 | 43 |
| Total number of passengers entering or leaving Victoria Line stations | 372,000 | 100 | 521,800 | 100 | 40 |
| Corresponding total number of passenger journeys | 186,000 | – | 260,900 | – | 40 |

**APPENDIX D**
**VICTORIA LINE TRAFFIC STUDY**

VICTORIA LINE PASSENGER SURVEY MAY/JUNE 1970

NUMBERS OF PASSENGERS PER WEEKDAY

TRAVELLING BETWEEN EACH PAIR OF VICTORIA LINE STATIONS

Walthamstow Central 16,800

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 500 | Blackhorse Road 7,300 | | | | | | | | | |
| 700 | 100 | Tottenham Hale 5,800 | | | | | | | | |
| 900 | 400 | 200 | Seven Sisters 20,600 | | | | | | | |
| 2,100 | 1,200 | 700 | 2,000 | Finsbury Park 53,000 | | | | | | |
| 800 | 500 | 200 | 1,600 | 6,700 | Highbury & Islington 22,400 | | | | | |
| 2,800 | 1,100 | 800 | 4,200 | 7,200 | 3,000 | King's Cross 43,700 | | | | |
| 900 | 300 | 400 | 1,200 | 3,200 | 1,400 | 1,300 | Euston 41,800 | | | |
| 1,000 | 400 | 400 | 1,600 | 4,000 | 1,100 | 1,000 | 500 | Warren Street 24,600 | | |
| 3,800 | 1,500 | 1,200 | 4,400 | 13,300 | 3,500 | 8,100 | 11,900 | 3,800 | Oxford Circus 113,100 | |
| 1,100 | 400 | 300 | 1,200 | 3,400 | 1,200 | 3,000 | 6,000 | 2,000 | 11,200 | Green Park 49,500 |
| 2,200 | 900 | 800 | 2,900 | 9,200 | 2,400 | 11,200 | 14,700 | 8,800 | 50,400 | 19,700 | Victoria 123,200 |

## APPENDIX E
## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEYS MAY/JUNE 1969/1970.

### NUMBERS OF PASSENGERS PER WEEKDAY AND PER ANNUM, USING EACH SECTION OF THE LINE

| Section of line | Per weekday | | | Per annum | | | |
|---|---|---|---|---|---|---|---|
| | May/June 1969 | May/June 1970 | Increase 1970 over 1969 per cent. | May/June 1969 | | May/June 1970 | |
| | Numbers | | | Numbers (millions) | per cent. of mean density | Numbers (millions) | per cent. of mean density |
| Walthamstow C.– Blackhorse Road | 14,000 | 16,800 | 20 | 4.4 | 27 | 5.2 | 23 |
| Blackhorse Road – Tottenham Hale | 19,000 | 23,100 | 22 | 5.9 | 36 | 7.2 | 32 |
| Tottenham Hale – Seven Sisters | 22,000 | 27,300 | 24 | 6.9 | 42 | 8.5 | 38 |
| Seven Sisters – Finsbury Park | 32,000 | 44,900 | 40 | 10.0 | 61 | 14.0 | 62 |
| Finsbury Park – Highbury & Islington | 64,000 | 85,900 | 34 | 20.0 | 122 | 26.8 | 118 |
| Highbury & Islington – King's Cross | 64,000 | 88,700 | 39 | 20.0 | 122 | 27.6 | 122 |
| King's Cross – Euston | 66,000 | 94,200 | 43 | 20.6 | 126 | 29.5 | 130 |
| Euston – Warren Street | 83,000 | 118,600 | 43 | 25.9 | 158 | 37.1 | 164 |
| Warren Street – Oxford Circus | 86,000 | 123,200 | 43 | 26.9 | 164 | 38.5 | 170 |
| Oxford Circus – Green Park | 94,000 | 133,300 | 42 | 29.4 | 179 | 41.6 | 184 |
| Green Park – Victoria | 84,000 | 123,200 | 47 | 26.3 | 160 | 38.5 | 170 |
| Mean annual density (Total passenger mileage divided by route mileage) | | | | 16.4 | 100 | 22.6 | 100 |

## APPENDIX F

## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEY MAY/JUNE 1970

### NUMBERS OF PASSENGERS PER WEEKDAY ENTERING OR LEAVING EACH VICTORIA LINE STATION, BY MODES OF TRANSPORT USED BEFORE OR AFTER THE VICTORIA LINE STAGE OF THE JOURNEY

| Station \ Mode | Underground | | | | | | British Rail | Bus | Car | Other (mainly walking) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Piccadilly Line | Northern Line | Central Line | Bakerloo Line | District Met. & Circle Lines | Total | | | | | |
| Walthamstow C. | – | – | – | – | – | – | 2,200 | 7,200 | 2,200 | 5,200 | 16,800 |
| Blackhorse Road | – | – | – | – | – | – | – | 2,000 | 1,400 | 3,900 | 7,300 |
| Tottenham Hale | – | – | – | – | – | – | 2,700 | 100 | 200 | 2,800 | 5,800 |
| Seven Sisters | – | – | – | – | – | – | 8,300 | 3,900 | 600 | 7,800 | 20,600 |
| Finsbury Park | 20,500 | – | – | – | – | 20,500 | 6,600 | 15,000 | 1,400 | 9,500 | 53,000 |
| Highbury & Islington | – | 5,700 | – | – | – | 5,700 | 500 | 2,000 | 800 | 13,400 | 22,400 |
| King's Cross | 4,400 | 4,200 | – | – | 8,600 | 17,200 | 13,800 | 1,600 | 100 | 11,000 | 43,700 |
| Euston | – | 19,400 | – | – | – | 19,400 | 2,500 | – | 200 | 9,700 | 41,800 |
| Warren Street | – | 3,300 | – | – | – | 3,300 | – | 600 | 200 | 20,500 | 24,600 |
| Oxford Circus | – | – | 26,900 | 26,000 | – | 52,900 | – | 500 | 0 | 59,700 | 113,100 |
| Green Park | 10,700 | – | – | – | – | 10,700 | – | 500 | 100 | 38,200 | 49,500 |
| Victoria | – | – | – | – | 22,900 | 22,900 | 62,800 | 5,200 | 200 | 32,100 | 123,200 |
| Totals (% of Grand Total) | 35,600 (7) | 32,600 (6) | 26,900 (5) | 26,000 (5) | 31,500 (6) | 152,600 (29) | 109,400 (21) | 38,600 (7½) | 7,400 (1½) | 213,800 (41) | 521,800 (100) |

## APPENDIX G
## VICTORIA LINE TRAFFIC STUDY

VICTORIA LINE PASSENGER SURVEYS MAY/JUNE 1969/1970

NUMBERS OF PASSENGERS PER WEEKDAY
ENTERING VICTORIA LINE PLATFORMS
DURING DIFFERENT PERIODS OF THE DAY

| Period of the day | May/June 1969 | | May/June 1970 | | Increase 1970 over 1969 per cent. |
|---|---|---|---|---|---|
| | Numbers | per cent. of whole day | Numbers | per cent. of whole day | |
| Morning peak (07.00 to 10.00) | 58,800 | 31.6 | 84,700 | 32.5 | 44 |
| Evening peak (16.30 to 19.00) | 57,200 | 30.8 | 80,700 | 30.9 | 41 |
| Total, peak periods | 116,000 | 62.4 | 165,400 | 63.4 | 43 |
| Mid-day (10.00 to 16.30) | 47,500 | 25.5 | 65,700 | 25.2 | 38 |
| Evening (19.00 to 22.00) | 13,700 | 7.4 | 18,300 | 7.0 | 34 |
| Total (07.00 to 22.00) | 177,200 | 95.3 | 249,400 | 95.6 | 41 |
| Allowance for early morning and late evening | 8,800 | 4.7 | 11,500 | 4.4 | 31 |
| Total, all day | 186,000 | 100 | 260,900 | 100 | 40 |

## APPENDIX H
## VICTORIA LINE TRAFFIC STUDY

VICTORIA LINE PASSENGER SURVEY MAY/JUNE 1970

NUMBERS OF PASSENGERS DURING PEAK HOURS, PER WEEKDAY AND PER ANNUM
ON EACH SECTION OF THE LINE

| Section of line | Peak hour | | | | All-day (Weekdays) | | Peak-hour one-way in per cent. of | | All year two-way (millions) | Ratio of all-year two-way and peak hour one-way |
|---|---|---|---|---|---|---|---|---|---|---|
| | 08.30 -- 09.30 | | 17.00 – 18.00 | | | | | | | |
| | South-bound | North-bound | South-bound | North bound | one-way | two-way | all-day one-way | all-day two-way | | |
| Walthamstow C. – Blackhorse Rd | 1,700 | 300 | 400 | 3,400 | 8,400 | 16,800 | 40 | 20 | 5.2 | 1500 |
| Blackhorse Rd. – Tottenham Hale | 2,300 | 400 | 600 | 4,200 | 11,550 | 23,100 | 35 | 18 | 7.2 | 1700 |
| Tottenham Hale – Seven Sisters | 2,800 | 500 | 1,000 | 4,500 | 13,650 | 27,300 | 33 | 16 | 8.5 | 1900 |
| Seven Sisters – Finsbury Park | 5,100 | 800 | 1,400 | 6,900 | 22,450 | 44,900 | 31 | 15 | 14.0 | 2000 |
| Finsbury Park – Highbury & Isl. | 14,100 | 1,200 | 2,300 | 13,000 | 42,950 | 85,900 | 33 | 16 | 26.8 | 1900 |
| Highbury & Isl. – King's Cross | 12,900 | 1,600 | 2,900 | 12,400 | 44,350 | 88,700 | 29 | 15 | 27.6 | 2100 |
| King's Cross – Euston | 12,300 | 2,200 | 3,700 | 12,900 | 47,100 | 94,200 | 27 | 14 | 29.5 | 2300 |
| Euston – Warren Street | 17,000 | 2,700 | 4,500 | 16,000 | 59,300 | 118,600 | 29 | 14 | 37.1 | 2200 |
| Warren Street – Oxford Circus | 15,500 | 4,900 | 6,100 | 15,000 | 61,600 | 123,200 | 25 | 13 | 38.5 | 2500 |
| Oxford Circus – Green Park | 11,200 | 11,500 | 11,700 | 11,300 | 66,650 | 133,300 | 18 | 9 | 41.6 | 3600 |
| Green Park – Victoria | 6,300 | 14,800 | 15,000 | 7,100 | 61,600 | 123,200 | 24 | 12 | 38.5 | 2600 |

## VICTORIA LINE TRAFFIC STUDY

APPENDIX J

### VICTORIA LINE PASSENGER SURVEY MAY/JUNE 1970

### NUMBERS OF "DIVERTED" JOURNEYS PER WEEKDAY BY MODES OF TRANSPORT USED "BEFORE" AND "AFTER" THE OPENING OF THE VICTORIA LINE

| Before \ After | Underground only | Car and Underground | Bus and Underground | B.R. and Underground | Car, B.R. & Underground | Bus, B.R. & Underground | Car, Bus & Underground | Totals |
|---|---|---|---|---|---|---|---|---|
| Car only | 1,700 | 700 | 700 | 1,100 | 600 | 600 | 100 | 5,500 |
| Bus only | 12,100 | 400 | 6,900 | 1,900 | 200 | 400 | – | 21,900 |
| B.R. only | 500 | 100 | 400 | 2,100 | – | 100 | – | 3,200 |
| Underground only | 43,600 | 1,200 | 2,100 | 2,200 | 200 | 100 | – | 49,400 |
| Car and B.R. | – | – | – | 100 | 1,200 | – | – | 1,300 |
| Car and Underground | 200 | 5,400 | 200 | 300 | 600 | – | – | 6,700 |
| Bus and B.R. | 500 | – | 400 | 10,300 | 200 | 3,900 | – | 15,300 |
| Bus and Underground | 6,000 | 900 | 20,000 | 2,100 | 200 | 1,400 | – | 30,600 |
| B.R. and Underground | 2,900 | 500 | 1,000 | 38,100 | 600 | 600 | – | 43,700 |
| Car, B.R. & Underground | – | 500 | 100 | 200 | 14,100 | 100 | – | 15,000 |
| Bus, B.R. & Underground | 400 | 100 | 2,200 | 1,000 | 300 | 8,800 | – | 12,800 |
| Car, Bus & Underground | – | 100 | – | – | – | – | 300 | 400 |
| Car, Bus and B.R. | – | – | – | 100 | 3,500 | – | – | 3,600 |
| Total | 67,900 | 9,900 | 34,000 | 59,500 | 21,700 | 16,000 | 400 | 209,400 |

## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEY, MAY/JUNE 1970

### EFFECT OF THE VICTORIA LINE ON SELECTED SECTIONS OF OTHER RAILWAYS

"After" column : Daily numbers of Victoria Line passengers who in May 1970 also used the railway sections concerned.

"Before" column : Daily numbers of Victoria Line passengers diverted from "rail or mixed modes" who used the railway sections concerned before they started to use the Victoria Line (after adding 64% for previous journeys which would have been diverted but for a change in personal circumstances).

| Section of line | Before | After | Net increase (+) or decrease (–) in daily journeys | Net increase (+) or decrease (–) in annual journeys (millions) |
|---|---|---|---|---|
| **Piccadilly Line** | | | | |
| Barons Court – Earl's Court | 4,600 | 3,200 | – 1,400 | – 0.4 |
| Earl's Court – Gloucester Road | 5,900 | 4,100 | – 1,800 | – 0.6 |
| South Kensington – Knightsbridge | 10,000 | 5,500 | – 4,500 | – 1.4 |
| Knightsbridge – Hyde Park Corner | 11,200 | 7,300 | – 3,900 | – 1.2 |
| Hyde Park Corner – Green Park | 12,500 | 7,700 | – 4,800 | – 1.5 |
| Green Park – Piccadilly Circus | 28,300 | 3,700 | – 24,600 | – 7.7 |
| Piccadilly Circus – Leicester Square | 30,300 | 2,600 | – 27,700 | – 8.6 |
| Covent Garden – Holborn | 35,000 | 2,700 | – 32,300 | – 10.1 |
| Holborn – Russell Square | 42,300 | 4,000 | – 38,300 | – 12.0 |
| Russell Square – King's Cross | 42,700 | 4,500 | – 38,200 | – 11.9 |
| King's Cross – Caledonian Road | 44,700 | 3,500 | – 41,200 | – 12.9 |
| Holloway Road – Arsenal | 43,400 | 3,100 | – 40,300 | – 12.6 |
| Arsenal – Finsbury Park | 42,300 | 3,000 | – 39,300 | – 12.3 |
| Finsbury Park – Manor House | 28,500 | 16,800 | – 11,700 | – 2.6 |
| Manor House – Turnpike Lane | 20,300 | 14,400 | – 5,900 | – 1.8 |
| Turnpike Lane – Wood Green | 14,200 | 11,400 | – 2,800 | – 0.9 |
| Wood Green – Bounds Green | 10,600 | 8,700 | – 1,900 | – 0.6 |

| Section of line | Before | After | Net increase (+) or decrease (–) in daily journeys | Net increase (+) or decrease (–) in annual journeys (millions) |
|---|---|---|---|---|
| **Central Line** | | | | |
| Shepherd's Bush – Holland Park | 4,500 | 4,400 | – 100 | |
| Lancaster Gate – Marble Arch | 4,800 | 8,000 | + 3,200 | + 1.0 |
| Marble Arch – Bond Street | 6,900 | 10,200 | + 3,300 | + 1.0 |
| Bond Street – Oxford Circus | 11,600 | 14,500 | + 2,900 | + 0.9 |
| Oxford Circus – Tottenham Court Road | 29,500 | 12,000 | – 17,500 | – 5.5 |
| Tottenham Court Road – Holborn | 22,500 | 9,600 | – 12,900 | – 4.0 |
| Holborn – Chancery Lane | 17,500 | 6,800 | – 10,700 | – 3.3 |
| St. Paul's – Bank | 17,100 | 4,400 | – 12,700 | – 4.0 |
| Bank – Liverpool Street | 15,800 | 3,800 | – 12,000 | – 3.7 |
| Liverpool Street – Bethnal Green | 4,300 | 1,700 | – 2,600 | – 0.8 |
| Bethnal Green – Mile End | 4,100 | 1,600 | – 2,500 | – 0.8 |
| Mile End – Stratford | 5,300 | 1,400 | – 3,900 | – 1.2 |
| Stratford – Leyton | 5,000 | 1,100 | – 3,900 | – 1.2 |
| Leyton – Leytonstone | 3,300 | 1,000 | – 2,300 | – 0.7 |
| Leytonstone – Snaresbrook | 2,300 | 700 | – 1,600 | – 0.5 |
| Snaresbrook – South Woodford | 2,000 | 500 | – 1,500 | – 0.5 |
| **Metropolitan and Circle Lines** | | | | |
| Edgware Road – Baker Street | 4,300 | 1,300 | – 3,000 | – 0.9 |
| Finchley Road – Baker Street | 4,100 | 4,300 | + 200 | + 0.1 |
| Baker Street – Great Portland Street | 7,400 | 3,400 | – 3,000 | – 0.9 |
| Great Portland Street – Euston Square | 9,100 | 3,700 | – 5.400 | – 1.7 |
| Euston Square – King's Cross | 11,200 | 3,800 | – 7,400 | – 2.3 |
| King's Cross – Farringdon | 8,600 | 4,100 | – 4,500 | – 1.4 |
| Moorgate – Liverpool Street | 7,800 | 1,300 | – 6,500 | – 2.0 |
| Liverpool Street – Aldgate | 6,500 | | – 6,500 | – 2.0 |
| **District and Circle Lines** | | | | |
| West Kensington – Earl's Court | 3,600 | 3,300 | – 300 | – 0.1 |
| Earl's Court – Gloucester Road | 2,800 | 7,500 | + 4,700 | + 1.5 |
| South Kensington – Sloane Square | 8,700 | 11,400 | + 2,700 | + 0.8 |
| Sloane Square – Victoria | 10,100 | 15,200 | + 5,100 | + 1.6 |
| Victoria – St. James's Park | 34,300 | 7,900 | – 26,400 | – 8.2 |
| St. James's Park – Westminster | 41,800 | 2,500 | – 39,300 | –12.3 |
| Westminster – Charing Cross | 43,800 | 1,500 | – 42,300 | –13.2 |
| Charing Cross – Temple | 10,800 | 1,500 | – 9,300 | – 2.9 |
| Blackfriars – Mansion House | 9,000 | 800 | – 8,200 | – 2.6 |
| Cannon Street – Monument | 8,900 | 800 | – 8,100 | – 2.5 |
| Monument – Tower Hill | 8,300 | 700 | – 7,600 | – 2.4 |
| Aldgate – Liverpool Street | 6,500 | 0 | – 6,500 | – 2.0 |
| West Brompton – Earl's Court | 3,000 | 3,800 | + 800 | + 0.2 |
| High Street Kensington – Notting Hill Gate | 5,900 | 100 | – 5,800 | – 1.8 |
| Bayswater – Paddington | 3,900 | 200 | – 3,700 | – 1.2 |
| High Street Kensington – Gloucester Road | 5,000 | 500 | – 4,500 | – 1.4 |

| Section of line | Before | After | Net increase (+) or decrease (–) in daily journeys | Net increase (+) or decrease (–) in annual journeys (Millions) |
|---|---|---|---|---|
| **Northern Line** | | | | |
| Drayton Park – Highbury & Islington | 3,500 | 400 | – 3,100 | – 1.0 |
| Highbury & Islington – Essex Road | 4,400 | 4,900 | + 500 | + 0.2 |
| Old Street – Moorgate | 3,700 | 3,200 | – 500 | – 0.2 |
| East Finchley – Highgate | 6,800 | 5,600 | – 1,200 | – 0.4 |
| Highgate – Archway | 9,700 | 6,600 | – 3,100 | – 1.0 |
| Archway – Tufnell Park | 11,500 | 7,800 | – 3,700 | – 1.2 |
| Kentish Town – Camden Town | 12,900 | 9,100 | – 3,800 | – 1.2 |
| Mornington Crescent – Euston | 18,200 | 10,500 | – 7,700 | – 2.4 |
| Euston – Warren Street | 30,100 | 1,700 | – 28,400 | – 8.9 |
| Warren Street – Goodge Street | 33,500 | 2,700 | – 30,800 | – 9.6 |
| Goodge Street – Tottenham Court Road | 35,900 | 1,800 | – 34,100 | – 10.6 |
| Tottenham Court Road – Leicester Square | 27,900 | 1,200 | – 26,700 | – 8.3 |
| Leicester Square – Strand | 30,300 | 1,100 | – 29,200 | – 9.1 |
| Charing Cross – Waterloo | 7,200 | 800 | – 6,400 | – 2.0 |
| Waterloo – Kennington | 3,900 | 300 | – 3,600 | – 1.1 |
| Chalk Farm – Camden Town | 9,400 | 8,700 | – 700 | – 0.2 |
| Camden Town – Euston | 3,600 | 8,800 | + 5,200 | + 1.6 |
| Euston – King's Cross | 5,700 | 1,000 | – 4,700 | – 1.5 |
| King's Cross – Angel | 7,900 | 3,900 | – 4,000 | – 1.3 |
| Old Street – Moorgate | 7,700 | 1,800 | – 5,900 | – 1.8 |
| Moorgate – Bank | 8,000 | 1,800 | – 6,000 | – 1.9 |
| Bank – London Bridge | 6,300 | 1,000 | – 5,300 | – 1.7 |
| **Bakerloo Line** | | | | |
| St. John's Wood – Baker Street | 4,900 | 7,200 | + 2,300 | + 0.7 |
| Warwick Avenue – Paddington | 3,800 | 1,900 | – 1,900 | – 0.6 |
| Marylebone – Baker Street | 5,900 | 6,500 | + 600 | + 0.2 |
| Baker Street – Regent's Park | 13,400 | 18,000 | + 4,600 | + 1.4 |
| Regent's Park – Oxford Circus | 15,200 | 19,500 | + 4,300 | + 1.3 |
| Oxford Circus – Piccadilly Circus | 25,100 | 6,200 | – 18,900 | – 5.9 |
| Piccadilly Circus – Trafalgar Square | 21,300 | 4,800 | – 16,500 | – 5.1 |
| Charing Cross – Waterloo | 4,200 | 3,200 | – 1,000 | – 0.3 |
| Lambeth North – Elephant & Castle | 2,100 | 300 | – 1,800 | – 0.6 |
| **British Rail-Eastern Region** | | | | |
| Liverpool Street – Bethnal Green | 22,000 | 400 | – 21,600 | – 6.7 |
| Hackney Downs – Clapton | 12,300 | 0 | – 12,300 | – 3.8 |
| Clapton – St. James' Street | 11,400 | 0 | – 11,400 | – 3.5 |
| St. James' Street – Walthamstow Central | 9,400 | 100 | – 9,300 | – 2.9 |
| Walthamstow Central – Wood Street | 5,100 | 2,200 | – 2,900 | – 0.9 |
| Wood Street – Highams Park | 3,800 | 1,800 | – 2,000 | – 0.6 |

| Section of line | Before | After | Net increase (+) or decrease (–) in daily journeys | Net increase (+) or decrease (–) in annual journeys (Millions) |
|---|---|---|---|---|
| Stoke Newington – Stamford Hill | 9,900 | 400 | – 9,500 | – 3.0 |
| Stamford Hill – Seven Sisters | 9,900 | 400 | – 9,500 | – 3.0 |
| Seven Sisters – Bruce Grove | 9,500 | 7,800 | – 1,700 | – 0.5 |
| Lower Edmonton – Bush Hill Park and Southbury | 7,300 | 5,500 | – 1,800 | – 0.6 |
| Northumberland Park – Tottenham Hale | 1,100 | 2,400 | + 1,300 | + 0.4 |
| King's Cross – Finsbury Park | 9,000 | 6,700 | – 2,300 | – 0.8 |
| Finsbury Park – Harringay West | 14,000 | 12,200 | – 1,800 | – 0.6 |
| Harringay West – Hornsey | 13,600 | 12,000 | – 1,600 | – 0.5 |
| Hornsey – Wood Green | 13,600 | 12,000 | – 1,600 | – 0.5 |
| Liverpool Street – Stratford | 2,000 | 1,600 | – 400 | – 0.1 |
| Stratford – Maryland | 2,200 | 1,900 | – 300 | – 0.1 |
| **British Rail – Southern Region** | | | | |
| To and from Victoria | 44,400 | 62,800 | + 18,400 | + 6.0 |
| Vauxhall – Waterloo | 4,700 | 1,500 | – 3,200 | – 1.0 |
| To and from London Bridge | 8,200 | 500 | – 7,700 | – 2.4 |
| London Bridge – Waterloo | 3,100 | 400 | – 2,700 | – 0.8 |
| Waterloo – Charing Cross | 2,900 | 400 | – 2,500 | – 0.8 |
| **British Rail – London Midland Region** | | | | |
| To and from St. Pancras | 4,700 | 7,100 | + 2,400 | + 0.8 |
| To and from Euston | 10,900 | 12,500 | + 1,400 | + 0.5 |
| **Waterloo & City Line** | | | | |
| Waterloo – Bank | 1,000 | 0 | – 1,000 | – 0.3 |

APPENDIX L

## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEYS MAY/JUNE 1969/1970

### NUMBERS OF PASSENGERS PER ANNUM ON EACH SECTION OF THE LINE, COMPARED WITH EARLIER FORECASTS (MILLIONS)

| Section of line | Forecasts | | | Surveys | |
|---|---|---|---|---|---|
| | 1955 | 1958 | 1969 | May/June 1969 | May/June 1970 |
| Walthamstow Wood Street – Walthamstow Central | 4 | 4 | – | – | – |
| Walthamstow Central – Blackhorse Road | 8 | 8 | 5 | 4½ | 5 |
| Blackhorse Road – Tottenham Hale | 11 | 11 | 8 | 6 | 7 |
| Tottenham Hale – Seven Sisters | 14 | 14 | 9 | 7 | 8½ |
| Seven Sisters – Finsbury Park | 22 | 22 | 13 | 10 | 14 |
| Finsbury Park – Highbury & Islington – | 28 | 29 | 22 | 20 | 27 |
| Highbury & Islington King's Cross | 28 | 32½ | 20½ | 20 | 27½ |
| King's Cross – Euston | 32 | 35 | 21 | 20½ | 29½ |
| Euston – Warren Street | 39 | 42 | 26½ | 26 | 37 |
| Warren Street – Oxford Circus | 40 | 43 | 26 | 27 | 38½ |
| Oxford Circus – Green Park | 31 | 32 | 23½ | 29½ | 41½ |
| Green Park – Victoria | 30 | 31 | 21½ | 26 | 38½ |
| Total annual passenger mileage | 250 | 263 | 169 | 165 | 229 |

## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEY MAY/JUNE 1970

### NUMBERS OF PASSENGERS DURING P.M. PEAK HOUR ON EACH SECTION OF LINE, COMPARED WITH FORECASTS

| Section of line | Forecast 1955 | Forecast 1969 | Survey May/June 1970 |
|---|---|---|---|
| **NORTHBOUND** | | | |
| Walthamstow Central – Blackhorse Road | No estimates recorded | 2,600 | 3,400 |
| Blackhorse Road – Tottenham Hale | | 3,800 | 4,200 |
| Tottenham Hale – Seven Sisters | | 4,500 | 4,500 |
| Seven Sisters – Finsbury Park | | 6,700 | 6,900 |
| Finsbury Park - Highbury & Islington | 14,000 | 11,600 | 13,000 |
| Highbury & Islington King's Cross | 14,000 | 9,100 | 12,400 |
| King's Cross – Euston | 14,000 | 9,900 | 12,900 |
| Euston – Warren Street | 16,000 | 11,600 | 16,000 |
| Warren Street – Oxford Circus | 16,000 | 11,400 | 15,000 |
| **SOUTHBOUND** | | | |
| Oxford Circus – Green Park | 13,000 | 10,400 | 11,700 |
| Green Park – Victoria | 14,000 | 12,600 | 15,000 |

## VICTORIA LINE TRAFFIC STUDY

### VICTORIA LINE PASSENGER SURVEY MAY/JUNE 1970

### NUMBERS OF PASSENGERS DURING P.M. PEAK HOUR IN SOME SELECTED INTERCHANGE TRAFFIC FLOWS BETWEEN THE VICTORIA LINE AND OTHER UNDERGROUND LINES COMPARED WITH FORECASTS

| Interchange traffic flow | 1969 Forecast | May/June 1970 Survey |
|---|---|---|
| **Finsbury Park** | | |
| From Victoria Line (South) to Piccadilly Line (North) | 2,500 | 2,800 |
| From Piccadilly Line (South) to Victoria Line (North) | 700 | 600 |
| **Highbury & Islington** | | |
| From Northern Line (South) to Victoria Line (North) | 2,600 | 900 |
| **King's Cross** | | |
| From Metropolitan Line (West) to Victoria Line (North) | 300 | 300 |
| From Piccadilly Line (South) to Victoria Line (North) | 400 | 400 |
| **Euston** | | |
| From Victoria Line (South) to Northern Line (North) | 1,600 | 2,100 |
| **Oxford Circus** | | |
| From Victoria Line (South) to Bakerloo Line (North) | 1,500 | 1,900 |
| From Bakerloo Line (South) to Victoria Line (North) | 1,000 | 800 |
| From Central Line (East) to Victoria Line (South) | 1,200 | 1,300 |
| **Green Park** | | |
| From Piccadilly Line (East) to Victoria Line (South) | 500 | 400 |
| From Victoria Line (North) to Piccadilly Line (West) | 400 | 400 |
| **Victoria** | | |
| From Victoria Line (North) to District Line (West) | 1,800 | 1,400 |
| From District Line (East) to Victoria Line (North) | 1,200 | 900 |

## VICTORIA LINE TRAFFIC STUDY

### G.L.C. HOUSEHOLD SURVEYS, AUGUST 1968 & AUGUST 1969

### NUMBERS OF "HOME-BASED" TRIPS BY MAIN MODE, PER WEEKDAY MADE BY APPROX. 150,000 PERSONS RESIDENT IN THE NORTHERN SUBURBS DIRECTLY OR INDIRECTLY SERVED BY THE VICTORIA LINE

| Main mode of travel | August 1968 | | August 1969 | | Increase or decrease | |
|---|---|---|---|---|---|---|
| | Numbers | Standardized | Numbers | Standardized. | Numbers | per cent. |
| | TRIPS FOR ALL PURPOSES | | | | | |
| Underground | 16,900 | 10½ | 23,110 | 14 | + 6,210 | + 36.7 |
| British Rail | 20,090 | 12½ | 17,370 | 11 | – 2,720 | – 13.5 |
| Total, Rail | 36,990 | 23 | 40,480 | 25 | + 3,490 | + 9.4 |
| Bus | 45,270 | 28 | 40,160 | 24 | – 5,110 | – 11.3 |
| Total, public transport | 82,260 | 51 | 80,640 | 49 | – 1,620 | – 2.0 |
| Total, private transport | 77,530 | 49 | 83,410 | 51 | + 5,880 | + 7.6 |
| Total, non-walk trips | 159,790 | 100 | 164,050 | 100 | + 4,260 | + 2.7 |
| Walk trips | 46,760 | 29 | 53,150 | 32 | + 6,390 | + 13.7 |
| Grand total | 206,550 | 129 | 217,200 | 132 | + 10,650 | + 5.2 |
| | ALL TRIPS OTHER THAN WORK TRIPS | | | | | |
| Underground | 2,490 | 5 | 4,810 | 8½ | + 2,320 | + 93.2 |
| British Rail | 2,780 | 5 | 3,250 | 5½ | + 470 | + 16.9 |
| Total, Rail | 5,270 | 10 | 8,060 | 14 | + 2,790 | + 52.9 |
| Bus | 15,460 | 30 | 14,580 | 25½ | – 880 | – 5.7 |
| Total, public transport | 20,730 | 40 | 22,640 | 39½ | + 1,910 | + 9.2 |
| Total, private transport | 30,650 | 60 | 34,640 | 60½ | + 3,990 | + 13.0 |
| Total, non-walk trips | 51,380 | 100 | 57,280 | 100 | + 5,900 | + 11.5 |
| Walk trips | 25,650 | 50 | 31,250 | 54 | + 5,600 | + 21.8 |
| Grand total | 77,030 | 150 | 88,530 | 154 | + 11,500 | + 14.9 |

## VICTORIA LINE TRAFFIC STUDY

### G.L.C. HOUSEHOLD SURVEYS, AUGUST 1968 & AUGUST 1969

### PERCENTAGE DISTRIBUTION OF ALL DAILY TRIPS BETWEEN HOME AND WORKPLACE BY "BEFORE" AND "AFTER" MAIN MODE

(Due to rounding, the percentages do not always cast to totals)

| Before \ After | Car driver | Car passenger | Motor-cycle | Walk & cycle | Bus | British Rail | Victoria Line | Other Underground lines | Other | Totals |
|---|---|---|---|---|---|---|---|---|---|---|
| Car driver | 28.4 | 0.4 | 0.1 | 0.8 | 0.6 | 0.4 | 0.4 | 0.5 | 0.1 | 31.8 |
| Car passenger | 0.8 | 2.2 | 0.1 | 0.2 | 0.7 | 0.2 | 0.2 | 0.2 | 0.1 | 4.6 |
| Motorcycle | 0.4 | 0.0 | 1.3 | 0.2 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 2.2 |
| Walk & cycle | 1.0 | 0.3 | 0.4 | 11.9 | 1.4 | 0.3 | 0.1 | 0.2 | 0.0 | 15.6 |
| Bus | 1.2 | 0.9 | 0.1 | 1.2 | 12.9 | 1.0 | 1.6 | 0.4 | 0.1 | 19.4 |
| British Rail | 0.8 | 0.2 | 0.0 | 0.2 | 0.8 | 10.7 | 2.4 | 0.2 | 0.0 | 15.2 |
| Underground | 0.8 | 0.4 | 0.0 | 0.2 | 0.7 | 0.3 | 2.1 | 6.7 | 0.0 | 11.1 |
| Other | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Totals | 33.4 | 4.3 | 2.0 | 14.8 | 17.2 | 12.9 | 7.0 | 8.2 | 0.3 | 100.0 |

373/234RP/500
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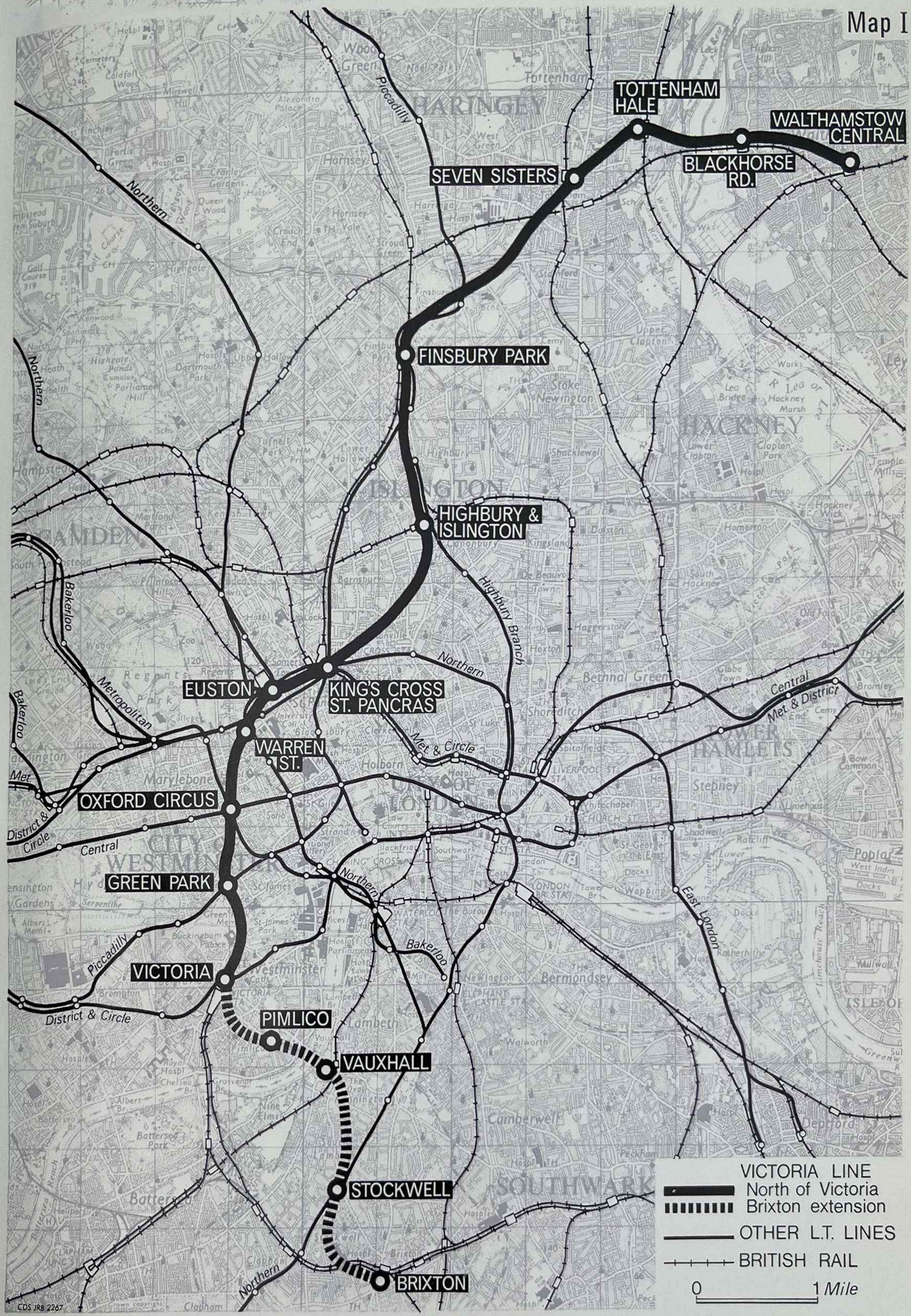
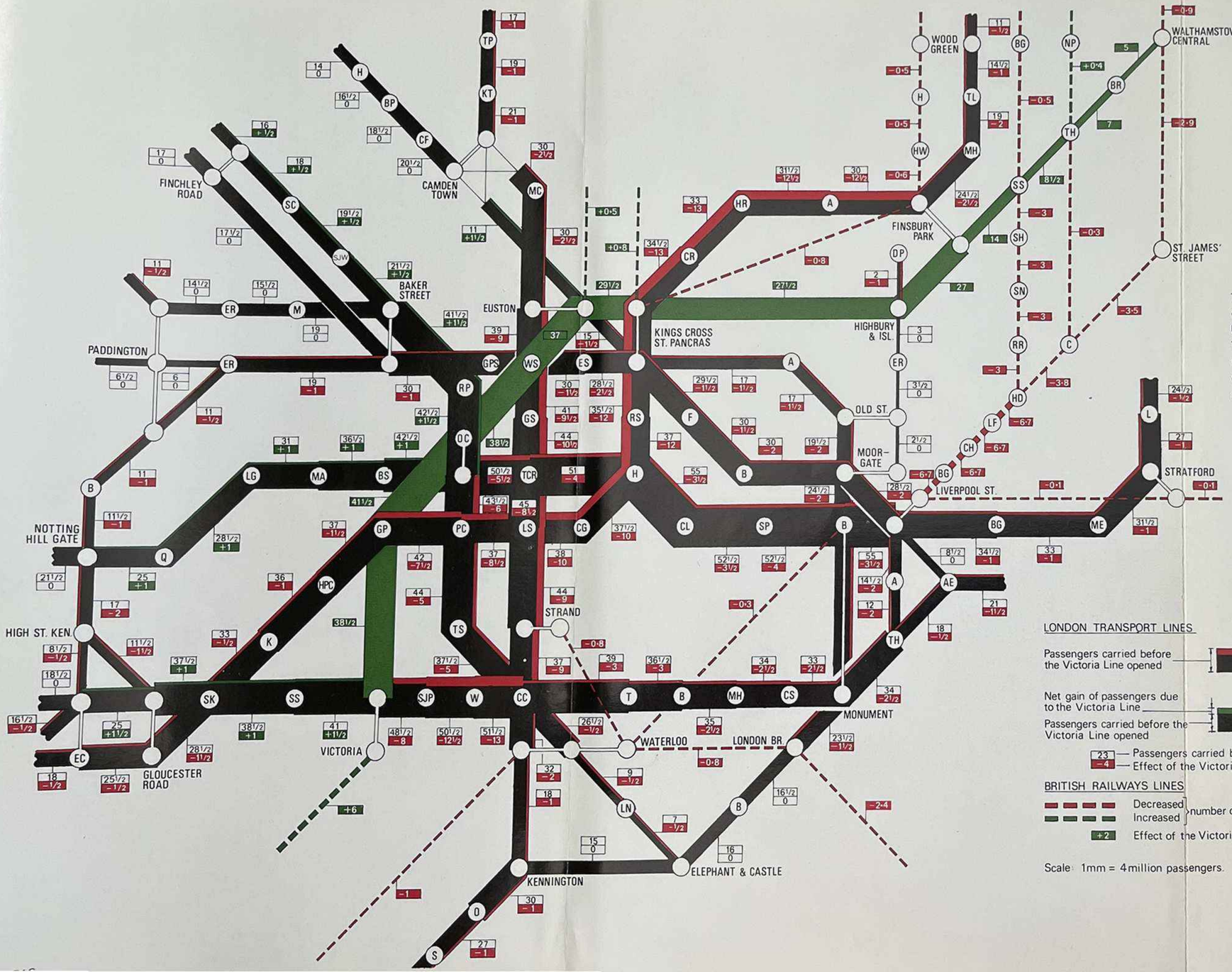
# Map I


TOTTENHAM HALE
WALTHAMSTOW CENTRAL
BLACKHORSE RD.
SEVEN SISTERS
FINSBURY PARK
HIGHBURY & ISLINGTON
EUSTON
KING'S CROSS ST. PANCRAS
WARREN ST.
OXFORD CIRCUS
GREEN PARK
VICTORIA
PIMLICO
VAUXHALL
STOCKWELL
BRIXTON
Piccadilly
Northern
Bakerloo
Metropolitan
District & Circle
Central
Met.
Met & Circle
Highbury Branch
Met. & District
East London
HARINGEY
ISLINGTON
CAMDEN
HACKNEY
TOWER HAMLETS
SOUTHWARK
WESTMINSTER
Lambeth
Bermondsey
Camberwell
Stepney
Bethnal Green
Marylebone
Holborn
Stoke Newington
Hackney Marsh
Wood Green
Tottenham
Hornsey
Crouch End
Highgate
Hampstead
Golders Green
Finchley
Victoria
Westminster
Battersea
Clapham
Brixton
Peckham
Deptford
Poplar
Millwall
Docks
CDS JRB 2267
VICTORIA LINE
North of Victoria
Brixton extension
OTHER L.T. LINES
BRITISH RAIL
0
1 Mile

MAP II

# EFFECT OF THE VICTORIA LINE (NORTH OF VICTORIA) ON TRAFFICS ON OTHER RAILWAY LINES




Total numbers of passengers per annum, both ways together, on individual sections of the Victoria Line and other Underground lines based on the May/June 1970 survey. The figures with positive or negative sign indicate the increase or decrease, respectively, due to the Victoria Line on certain sections of the Underground or British Railways compared with 1968.

The figures for British Railways' lines show only the effect of the Victoria Line, and not the absolute volume of traffic carried.

LONDON TRANSPORT LINES

Passengers carried before the Victoria Line opened — Net loss of passengers due to the Victoria Line; Passengers carried after the Victoria Line opened

Net gain of passengers due to the Victoria Line; Passengers carried before the Victoria Line opened — Passengers carried after the Victoria Line opened

23 — Passengers carried before the Victoria Line opened
−4 — Effect of the Victoria Line +(green) or −(red)
} million passengers per annum

BRITISH RAILWAYS LINES

Decreased
Increased
} number of passengers after the Victoria Line opened

+2 — Effect of the Victoria Line +(green) or −(red) million passengers per annum

Scale: 1mm = 4 million passengers. Any figure less than 4 million is not drawn to scale.

CDS 2269